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THE STREET RAILWAY MEETING.

Last week we devoted considerable space to the street railway convention at Saratoga, and this week are able to report the closing exercises, which included a good deal of matter of general interest. Now that the industry is so thoroughly electrified, many or most of its broad topics are those which receive attention from engineers in other branches of the art, and anything from telephones to turbines appears pertinent to the trolley. We think our general readers will thus find some valuable data in the Emmet paper on steam turbines and the subsequent discussion. The encouraging remarks on the turbine in practice, from so competent and conservative an engineer as Mr. Mailloux, must have great weight on coming development in power stations.

THE TELEGRAPHIC STATUS.

The wireless telegraph situation comes in for so much discussion, it rather crowds the older telegraph interests to the wall, as far as popular consideration is concerned. As a matter of fact, public interest in commercial telegraphy does not appear to be very great, and the reason may be the lack of anything sensational, either in its finances, its technique or its general development. For its great advances, wireless telegraphy has little to thank the earlier art and those who control it, and hence wire telegraphy is thought of as a thing apart. The time may come and perhaps is not far distant, when in view of the frequent interruptions of their lines, the telegraph companies may adopt a wireless system as an adjunct to be used in emergencies. This would be a sensible and progressive thing to do, but meantime the telegraph companies damn the wireless with faint praise—and possibly under their breath with what is not praise. Leaving aside the wireless, there are no great improvements visible in telegraphic technique, such as the adoption of "machine" or automatic methods; although doubtless there are sundry minor betterments which are too small to impress the public fancy, but which in the aggregate count a good deal for efficiency and economy. This may help to explain the encouraging report just issued by the Western Union for the September quarter, which shows a net revenue of $2,400,000, or $150,000 better than last year, and $700,000 better than the same quarter of 1900. To say the least, this is creditable, if the upkeep of the system has not suffered in doing it; and there is nothing to indicate that. It means apparently better executive and financial management, for we all recognize that there is little expansion in telegraphic income, whatever may be the explanation. Moreover, the surplus shown by the Western Union of $8,600,000 in 1900 has risen to $13,916,000, and the sturdy old "industrial" has gone right along paying its dividends all the while.

It so happens that just as these Western Union figures are available, some detail data comes to hand of the British telegraphs, as will be seen by other pages in this issue. On the face of the returns, the telegraph business in Great Britain in the hands of the government would appear to be growing more quickly than here; but if this be actually so, it is due to the cultivation of traffic at a losing rate. Now, it is not a peculiarly difficult trick to sell goods for less than they are worth; nor is it unusual that such a process should result in deficits. The British system does not make ends meet. It pays no dividend to the State on the investment, but calls all the time for more money. An explanation of the deficit is readily found in the fact that by means of very cheap press rates the Postmaster-

General makes the newspapers a present of at least $1,500,000 annually; and there are no signs that anybody will stop this leak, as they would in a merely commercial enterprise. But outside of that, the want of flexibility or growth in the business is seen again in the amount of traffic. Although the year 1902-3 was a banner period, the number of inland telegrams was only 75,883,000, and the total number, including foreign, was 92,471,000. This would seem to figure out somewhere around two messages per capita per year, or possibly just a little better than in the United States, where on the other hand the use of the telephone is far greater than in Great Britain. It strikes us that after all the telegraph falls short of its possibilities when barely two messages a year per head are all that the public can get out of it, directly, leaving out of consideration press dispatches. The great future question for telegraphy is, what can be done to make the two messages ten, and if something can be done, why it is not done. Not less than 160 trolley rides a year suffice for each American citizen, and we are strong enough believers in the telegraph to imagine that there must be ways and means of getting every good American to use the telegraph 6 or 16 times a year, as well.

AN ABUSE OF HOSPITALITY.

At the recent meeting of the American Street Railway Association one of the prominent members in commenting on the fact that no invitation has been extended to the Association for its next meeting, intimated in rather plain terms that this apparent lack of appreciation was owing to the great expense that in the past has been entailed upon hosts of the Association; and it was suggested that some plan be devised whereby members would henceforth individually and collectively pay their bills and the hosts be thus relieved of what has become a very considerable burden. This advice is applicable to other associations, and with particular force applies to the case of the professional organizations having no direct claims upon the generosity of corporate interests, the expenses of entertainment having thus to be met directly by local members or shifted by them in whole or in part on residents by an appeal to their public spirit. Professional men as a rule have little surplus to draw on for such a purpose, and a loss of dignity is entailed—to say the least—when the money for the entertainment of the visiting body is obtained from those having no connection whatever with its objects. It is only of recent years, we believe, that this practice—which originated in connection with junketing excursions of beneficial orders and commercial bodies—has extended to professional organizations. Time was when these latter met their own expenses, the usual banquet being arranged for on the basis of each member attending it paying for his own plate; and the sooner there is a return to this good old practice so consonant with self respect, the better will it be for the prestige of the bodies concerned. If the current practice is continued, before long invitations will be a rarity, and when given can neither be offered nor accepted in the true spirit which should animate host and guest.

THE CENTRAL STATION OF THE FUTURE.

It would indeed imperil a reputation as a prophet to hazard a prediction as to future improvements in the generation and utilization of electric current. The imagination might be acute enough by nature for such a task, but if long fettered by facts it would be unequal to the effort. In fact, the less one knows of electrical matters the easier it is to give one's fancy rein in so dizzy a flight. It may be, of course, that Boomer's etheric engine, Faques's battery and Curbhowler's xenon light may in the fullness of time replace the apparatus with which we are now familiar, but we are here assuming that in the matter of generation at least, no revolutionary changes are immediately impending. The great suburban transmission system in process of evolution about Boston, which has just been described in our columns will serve as a text, and the need of cities as the salient theme. If the present tendency of rapid aggregation of population in large cities goes on, the future must prepare to meet conditions which are feebly sketched by the present situations in New York and London. Not only will there be demands for power, light and rapid transit hardly now to be imagined, but it will require desperate efforts to meet the requirements with sufficient completeness to make the conditions of city life in the least more than tolerable. Last winter gave us a taste of the situation which will be usual within a few years unless it be averted by the most active measures. The price of coal is on an upward gradient which is likely to grow steeper as time goes on, and the near future is quite certain to see anthracite far too much of a luxury to be used for the generation of steam.

The time is ripe for just such operations as are in progress about Boston, but on a scale even more imposing. The supply not only of the city proper but of the greater city from one or a few huge central stations is the logical step when we are hard pushed for fuel and harassed by smoke. Much has been said of the relative economy of small and large stations, but when the whole story has been told from the engineer's standpoint and quite irrespective of his conclusions, the citizen must have the last word. We believe the time has come when soft coal-burning industries must be relegated to the outskirts of cities, and the great central stations now being erected are taking a step in the right direction. Before many years we think that the smaller urban stations for direct supply of electricity at low pressure, now being maintained for convenience and for auld acquaintance sake, must go or be relegated to the state of emergency stations only to be used in case of a breakdown. They have served their purpose well, but the need for them has passed and they must pass with it. If any prime movers belonging to the future central station system are to be installed away from the main plant, the gas engine will become a great factor in the situation. Even a gas engine with its very undesirable products of combustion is not a pleasant neighbor, but it does not fill the air with smoke. The use of steam engines with coal for fuel stands a chance of being prohibited in the civilized city of the near future, and the electric motor and the gas engine, being fully capable of meeting all requirements in the way of power, they will come more and more to the front. Even heating can be divided between gas and electricity with the best of results when one works on a sufficiently large scale. We even now do not allow soap factories and tanneries to flourish in residence districts. Why should we endure an equally obnoxious shower of soot?

We see then for the future city hope in the combined efforts of electricity and gas. The stage we are now in is merely transitional. Imagine a city as it might be without means not already available. Twenty or thirty miles away on barren land, perhaps on tidewater, perhaps surrounded by a network of railway tracks, are the power works of the metropolis—long rows of coking ovens and mighty gas receivers, a constantly moving mesh of automatic conveyors and the towering stacks of a gigantic power station wringing from the coke its final tribute of energy. The gas finds its use in every building for all production of heat, and feeds whenever desired the huge gas engines of the urban auxiliary stations. For lighting and motive power the city depends entirely on electricity; no steam engine turns within the city limits, no chimney belches out a cloud of soot—the air is as clear and the sky as bright as on the prairies. The use of gas engine reserve stations serves to hold the balance of supply and demand as between electricity and gas. The prospect is no vision of a dreamer, but a possibility that might be realized at any time

without passing the limits of conservative enterprise. The growth of cities is so swift and their demand for power so prodigious, that one has to look forward no more than a few years to see a market for power in one form or another so great as to justify fully the investment required for almost any reorganization of methods. Such an enterprise as we have described would of necessity be a complete monopoly and would thus imply rigid control by the municipality. The unutterable corruption of American municipal administrations is the sole bar to the success of such an advance. Progress waits for an era, not of Utopian fantasies, but of the common honesty that shall make for decent relations between great civic enterprises and the local governments under which they operate.

THE INTERNATIONAL CONFERENCE ON WIRELESS TELEGRAPHY.

The action taken at the recent International Congress held at Berlin to discuss wireless telegraphy is likely to have a marked influence upon the development of the art in Europe, and to a lesser extent upon the development of the art in America. Until recently the circumambient ether of our planet, while teeming with electromagnetic waves of wave length lesser than an inch, depended almost wholly upon thunderstorms for its longer waves. The only radiograms were sent by the thunder god. Of recent years, however, artificially-produced electromagnetic waves, of the order of wave length of dekametres, have sprung into existence like a new species of creation, owing to the activities of electrical engineers. So long as the range of these waves remained limited to a few kilometres, it did not matter how, or where, they originated. Every electrician for himself, and the atmosphere for us all, became the natural creed of wireless telegraphers. But when these new creatures began to extend their range, and roam about from one country to another, this altruistic doctrine of let-alone became burdensome alike to him who sends and him who receives. The messages did not fall upon the place beneath, but rather seemed anxious to fall upon the antipodes beneath. Then the doctrine of law of the real estate man rose into consideration, that he who owns the soil owns the sky. The new command went forth—thou shalt not sully my ether with long electromagnetic waves.

So a congress was called at Berlin last month to deliberate upon the new state of the art and to say who owned the sky electromagnetically. After eight days of discussion, the congress adopted a protocol of eight articles, which was signed by the representatives of the United States, Germany, Austria, Spain, France and Russia. This seems to have been the first occasion on which the United States has been a party to an international agreement on telegraphy, and in a sense may be accepted as an indication of the policy of the day to assert our status as a "world power." Fortunately in this case there is no probability that our navy and army will ever be called upon in support of the obligation assumed. Telegraphic conferences are held in Europe at regular intervals, and delegates to these conferences are appointed by various countries of Europe, Asia, Africa and Oceania; but America has hitherto stood aloof, bounded by the Atlantic and Pacific Oceans and the Monroe Doctrine. But what telegraphy could not do by sea or land to bring America into the fold, telegraphy has done by air. According to the protocol, wireless telegrams have been described as radiograms, and have been brought into co-ordination with ordinary telegrams, under the rules of the St. Petersburg telegraphic convention. The United States is not a party to the agreement reached by that convention, but it would seem that the United States has now become a party to that convention so far as its provisions now apply to radiograms. The most important decision was that coast stations for wireless telegraphy are obliged to receive and transmit telegrams going to or returning from ships, without distinction as to the system of wireless telegraphy employed by the ships.

This rule can hardly be regarded as mandatory, and can only go into effect through the subsequent action of the various governments individually. In itself, the rule can only be of the nature of a suggestion, or consensus of opinion, from the conference. Moreover, it is nugatory in its present form. If, for example, the coast stations should have their receivers tuned to a particular frequency, then passing ships with a particular favored system of radiography would readily enter into communication with the stations, by using that frequency in their transmitting apparatus; whereas the disfavored ships would not operate the shore stations' receivers. The only complaint that the disfavored ships could make under such circumstances would be that the shore stations tuned selectively, and this allegation might be difficult to prove. Nothing would be easier for the shore stations than to ignore radiograms from disfavored ships without any tangible evidence of favoritism, unless compelled by the government, or the courts, to treat all vessels alike. The effect of such a ruling would naturally be adverse to the establishment of monopoly in any particular system of wireless telegraphy, so far as relates to the operation of coast stations with passing ships. In this respect the rule, if enforced, would apparently affect the contract which Lloyds' Agency has already entered into with the Marconi Company, which contract is stated to provide for the shore stations exclusive exchange of messages with vessels equipped for wireless telegraphy by the Marconi Company. Great Britain did not sign the protocol, declaring that no system of wireless telegraphy would be used by that country officially until guarantees of service could be given that hitherto have been unobtainable. This fact may avoid bringing the protocol into a test conflict with Lloyds' Agency. Italy also dissented from the protocol on the ground that to subscribe would involve breaking a contract already made with the Marconi Company.

Whatever results may flow from the session of this important congress, it seems likely that no license or charter will be granted by any of the governments whose representatives signed the protocol, for any system of wireless telegraphy contemplating monopoly or exclusive communication with vessels on the sea. This is in itself a step forward in the direction of civilization. The protection of international shipping, of lives and property upon the sea, is of greater international and national importance than the maintenance of any monopoly. It is difficult to see how a government could interfere consistently with the recognized rights of individuals, in the operation of the ether over the land for the purposes of wireless telegraphy; but when the welfare of ships on the ocean is taken into account, the general welfare which keeps the seas neutral territory tends to keep the ether above them neutral also. The convocation of this congress is but another evidence of the tendency of physics in general, and of telegraphy in particular, to unite nations in bonds of co-operation. Every new telegraphic development, such as wireless telegraphy, not only promotes rapid intercommunication, virtually leveling mountains and bridging seas, but also brings new ties for amity and mutual understanding, whereby war becomes more difficult to invoke. If wireless telegraphy should develop into such increasing range and utility as to carry any considerable proportion of intercontinental telegraph traffic, it would render a closer understanding necessary between America and Europe in the various details of telegraphic operation. For instance, the difference between the American and the European Morse codes would have to disappear and universal wireless telegraphy would necessitate a universal code for telegraphy of every kind worked by hand.

The Convention of the Edison Illuminating Association.

For some years past the Association of Edison Illuminating Companies has shunned cities as meeting places for its conventions, and has sought secluded pleasure resorts where the end of the season gives it an added retirement because of the absence of other guests. It must be admitted, however, that in developing this passion for privacy, the Association has also cultivated a very discriminating taste in hotels, so that the record of its transactions might serve equally well as a Baedeker of the best pleasure resorts in America. This year the success achieved in 1902 by the meeting in the beautiful new hotel at the foot of Mt. Washington has again been followed up by the gathering at the Hotel Frontenac, a charming spot on one of the Thousand Islands, near Clayton; and the large attendance may in part be attributed to the reports which had circulated as to the attractions of a place, surrounded by a broad, deep river, whose only approach could be guarded by the vigilant eye of a single trusty. So quiet and withdrawn is the spot, even the caddies on the golf links have to make the trip over every morning, from Clayton, some few miles away, by steamer. There can be no doubt that by thus "letting concealment feed on its damask cheek" the Association is able to stick much closer to business; and its sessions are models of what work at a convention should be, with two and three of them, moreover, each day.

An element of melancholy was given to the convention this year by the absence of Mr. Luther Stieringer, so long the sergeant-at-arms, who died a few months ago in California. Although in every sense a free lance in the electrical field, fighting always for his own hand, Mr. Stieringer was one of the best friends and most loyal critics the Association has ever had, and it was with more than a tinge of sadness that the members in and out of meeting referred to his personality and to what he had done for the lighting art in providing it with some of its most useful and permanent features of security and flexibility. It is needless to add that his loss was appropriately recognized.

The meeting began on Tuesday, September 8, under the presidency of Mr. Louis A. Ferguson, of Chicago, but on account of the intervening Labor Day holiday, most of the delegates had arrived on Saturday or Sunday, and by the first day an attendance of at least 175 had been attained. The programme laid out, as given below, was followed out with trivial changes:

Tuesday, 9.30 A. M.—Roll Call, Announcement, Report of Executive Committee, Treasurer's Report, Report of Meter Committee. Discussion. Report of Storage Battery Committee, Report of Lamp Committee, Report of Committee on National Code. Paper, "Overhead Pole Line Construction and Operation," by Mr. A. H. Manwaring, and Mr. J. T. Hutchings, of Philadelphia. 8 P. M.—Paper, "Selection and Installation of High-Tension Switch Apparatus," by Mr. L. L. Elden, of Boston. Paper, "Operating Features of High-Tension Power Stations," by Mr. W. F. Wells, of New York. Discussion. Paper, "Comparison of European and American Engineering Practice," by Mr. Charles Schwartz, of Chicago. Discussion. Paper, "Notes on Commercial Features of European Lighting Practice," by Mr. Arthur Williams, of New York.

Wednesday, 9.30 A. M.—Paper, "Purchased Electric Power in Factories," by Mr. E. W. Lloyd, Chicago. Discussion. Paper, "Commercial Experience with Nernst and Meridian Lamps," by Mr. W. B. Thompson, of Detroit. Discussion. Paper, "The Development of Summer Lighting," by Mr. Edward A. Leslie, of Brooklyn. Discussion. Paper, "The Central Station and the Isolated Plant," by Mr. Douglas Burnett, of New York. Discussion.

Thursday, 9.30 A. M.—Paper, "Profitable Advertising," by Mr. Walter H. Johnson, of Philadelphia. Discussion. Paper, "Depreciation in Electric Light Plants," by H. M. Edwards. Discussion. 2.30 P. M. —Paper, "Results obtained with Steam Turbines in Milan," by Mr. Guido Semenza, of Milan, Italy. Discussion. Paper, "Steam Turbines," by Mr. August Kruesi, of Schenectady.

Thursday, 8 P. M.—Lecture on Illumination, by Dr. Charles P. Steinmetz.

Some part of the proceedings will probably be made available later, but as is well known, the Association sits in "executive session," at all times and hence a fuller report cannot be furnished. It was evident that the steam turbine was a topic uppermost in the minds of the members, and that great developments on their part await the tests which it is understood are now in process at the Chicago Edison plant, supplementing those already noted from Schenectady.

Although the Association does not invite outsiders, quite a few visitors participated in greater or lesser degree in what was going forward outside the convention hall. Among those present as guests were Dr. A. E. Kennelly, Professor of Electrical Engineering at Harvard University, and Mrs. Kennelly; J. G. White, of J. G. White & Co., and Mrs. White; A. J. Wurts, Westinghouse Electrical & Mfg. Company; Charles Blizard, Electric Storage Battery Company; T. C. Martin, ELECTRICAL WORLD AND ENGINEER; and Dr. C. P. Steinmetz, and Messrs. E. W. Rice, Jr., J. R. Lovejoy, A. L. Rohrer, and Messrs. Gilbert, Bates, Buddy, Hewlett, Wagoner, Gale and others, all of the General Electric Company. This parent company was, as usual, generous in its courtesies and hospitalities, and opened the ball on Tuesday by giving the ladies of the convention a delightful sail all around the Thousand Islands and Alexandria Bay.

Convention of the American Electrochemical Society.

As already announced, the fourth general meeting of the American Electrochemical Society will be held at Niagara Falls, N. Y., September 17th, 18th and 19th, 1903. The meeting will be held at the auditorium of the Cataract House, beginning at 9 A. M., Thursday, September 17th. Thursday and Friday afternoons will be devoted to visits to power houses and certain of the electrochemical plants which are open to visitors, and to other points of interest in the vicinity. Thursday evening there will be a smoker and entertainment at the Cataract-International. Friday evening a dance and reception will be given at the Cataract House. Saturday evening will be devoted to a trip to Niagara-on-the-Lake, Youngstown and Port Niagara by boat and trolley. The headquarters will be at the Cataract House. The special rates at the Cataract House and International Hotel are $3.50 to $5.00 per day American plan. For further information concerning hotels, the local secretary, C. L. Collins, 2nd, Niagara Falls, N. Y., should be addressed.

The following titles of papers have been announced, and are reprinted here for the benefit of those who may not have seen the earlier announcement: "A New Type of Electrolytic Cell," P. G. Salom; "Manufacture of Ferro-Alloys in the Electric Furnace," Dr. George P. Scholl; "Electrolytic Copper Refining," Dr. W. D. Bancroft; "Electrometallurgy of Gold," Dr. W. H. Walker; "Some Theoretical Considerations of Resistance Furnaces," F. A. J. Fitz-Gerald; "On the Supposed Electrolysis of Water Vapor," F. Austin Lidbury; "Efficiency of the Nickel Plating Tank," Prof. O. W. Brown; "Electrolysis of Sodium Hydroxide, by Alternating Current," Carl Hambuechen; "A Practical Utilization of the Passive State of Iron," Prof. C. F. Burgess; "The Present Status of the Theory of Electrolytic Dissociation," Dr. E. F. Roeber; "Berthelot's Law of Electrochemical Action," C. J. Reed. Other papers are expected from Dr. J. W. Richards, David H. Browne, Dr. L. Kahlenberg, Prof. C. F. Burgess, A. H. Cowles, and others. One session of the meeting will be devoted to the discussion of the theory of electrolytic dissociation, which will be opened by Dr. W. D. Bancroft.

Patents in Australia.

In trying to catch the socialistic labor vote in Australia, which, as is well known, has long been a country suffering from the dictation of trades unions, the Federal ministry has now introduced a Federal patents bill. One of the clauses is to the effect that on and after four years from the date of the invention no articles made in accordance with the specifications will be allowed to enter the Commonwealth. They must be produced in Australia. Again, if a patent be not worked within a certain specified period, say a couple of years, within the date of its being granted, it shall be declared null and void, wholly irrespective of any explanations which may be offered by the patentee. The whole tendency of the bill is adverse to the interests of inventors, and if accepted by the Federal Parliament it will discourage also the development of Australian inventive genius. Some light has been thrown on the action of the Commonwealth Ministry in the matter by the assertion that it is largely the work of a member of the Labor Party, who is a patent agent and holds advanced socialist views, the socialists holding that patent rights and monopoly of production are synonymous and opposed to the public interests.

Power Plant of the Cambridge Electric Light Company, Cambridge, Mass.

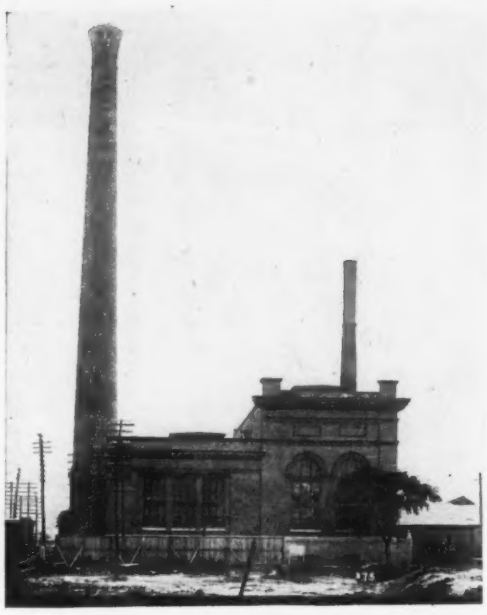


FIG. 1.—END VIEW OF STATION.

THE Cambridge Electric Light Company has recently completed a distinctly modern electric lighting and power plant on Western Avenue near the Charles River, in Cambridge, Mass. The new plant contains alternating-current apparatus of three-phase, 60-cycle type, the generators being direct-connected to vertical compound condensing engines using superheated steam. Among other notable features of the plant may be mentioned the lofty character of the building, which has resulted in well-lighted and ventilated boiler and engine rooms; an unusually light basement under the engine room, due to numerous outside windows in that story and to several openings in the engine room floor; the use of a traveling crane in the boiler room as well as in the engine room, and an extensive provision of special pipe hangers to allow for expansion changes in practically all classes of piping.

The power house is a steel frame building with brick walls and a timber roof supported by steel trusses. The street walls of the building are built with an enclosed air space of 8 in., and are faced on the outside with a cut-stone base course and surmounted at the roof by a heavy cornice and balustrade. In main dimensions the building is 106 ft. x 151 ft. 4 in. and is of the class in which the engine and boiler rooms are side by side, the longitudinal partition being composed, similarly to the street walls, of two 12-in. walls with 8 in. air space between. The boiler and engine rooms are of the same width, 50 ft., and are 145 ft. 8 in. long, but, if desired, one end wall may be torn down and indefinite extension made. The floor of the engine room is 10 ft. 9 in. above the level of the boiler room floor, and the basement floor 4 ft. 3 in. below it, leaving a clear height in that story of 13 ft. 8 in. In the boiler room, the lower chord of the roof trusses is 41 ft. 9 in. above the boiler room floor; in the engine room, the distance is about 52½ ft. In the case of each room, the roof has a large monitor. The interior walls of the boiler and engine rooms are of red glazed brick for the first 3½ ft., and are painted white, which is the predominating color inside of the building, above that point. The floors are all of fireproof construction. The crane in the engine room is a 25-ton, hand-power traveling crane, and in the boiler room is a crane of 5-ton capacity.

The boiler room contains two batteries of Babcock & Wilcox water-tube boilers, two boilers in each battery. There is space for a future installation of two similar batteries, so far as the present building is concerned. In addition to both main and auxiliary feed-water heaters, economizers have been provided, to utilize the heat of the flue gases. Located in the center of the present boiler room are two boiler feed pumps, the auxiliary feed-water heater and the economizer, the latter supported overhead, so that the floor space underneath is utilized for the pumps and heater. Incidentally the flue gases do not have to be carried downward in their passage from the boilers to the stack, which rises outside of the building as an entirely independent structure.

Each boiler contains 192 4-in. tubes 18 ft. long, arranged in 16 sections 12 pipes high, and two 42-in. steam drums 23 ft. 3⅝ in. long. They were built to carry 200 pounds pressure, and the steam connections are made so that before entering the steam header all the steam from each boiler must pass through a superheating coil which is located inside its respective boiler.

The smoke passage is located immediately behind the boilers and is of brick, its floor and ceiling consisting of arches sprung between light I-beams that extend from the partition wall to the boiler setting.

At the center of the boiler room the breeching is carried upward into the economizer setting, which is a brick structure carried on steel columns and beams from the boiler room floor and having brick arch floors and roof finished with Portland cement plaster. The setting is constructed to have a central direct smoke passage to the chimney with two sets of economizer tubes on each side. Half of the full boiler plant only having been installed, the second set of tubes has not been put in place, and as presently built, the economizer setting comprises one set and the by-pass. The economizer was built by the Green Fuel Economizer Company and consists of the usual 4-in. tubes 9 ft. high, arranged in one group of 520 tubes with one expansion space. The dampers of the inlet passages are hinged at the top and are lifted or lowered by means of a chain attached at the bottom of the damper and winding over a drum operated in each case by a hand crank through spur gearing. The dampers at the exit of the passages are suspended by chains at their axes, the chains passing through the top of the setting and twisting to turn the dampers. The economizer extends below the by-pass passage and the clean-out doors are located on the inner side of the economizer wall and under the by-pass passage. The chimney, which is located a short distance outside the boiler room, is of brick of the double-shell type, with a constant inside diameter of 9 ft. and a height above the grate bars of 255 ft.

The steam from each boiler is carried from the cross-connection joining the outlets of the two superheating coils in each boiler to a 16-in. header by means of a horizontal 8-in. wrought iron pipe bent horizontally. This pipe is connected into the side of the header, with a valve to the cross-connection and at the header. The header, which is of steel and supported by cast-iron roller bearing chains fastened by extension pedestals to the top of the smoke duct, is divided into four sections, corresponding to the four boilers, by gate valves. These are readily accessible from the roof of the smoke passage. The supply pipes to the engines already completed rise 8 in. in diameter in a long upward bend to a steam receiver and separator which is suspended in position by means of a special bend of gun metal passing through and anchored in the partition wall. From the top of the receiver, the engine supply continues 9 in. in diameter, with resultant reduction in velocity, and passes through the gun metal bend into the engine room where it reaches the high-pressure engine

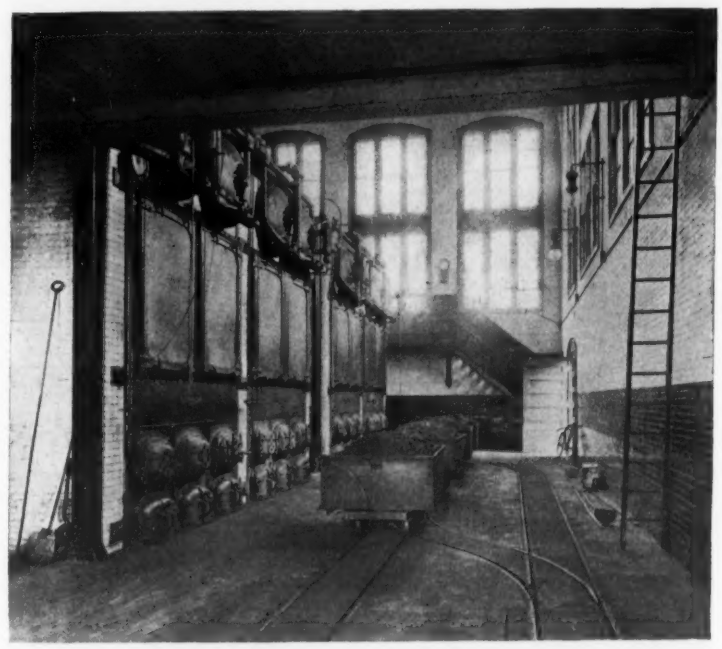


FIG. 2.—BOILER ROOM, CAMBRIDGE PLANT.

cylinder by means of long downward bend. Besides being a reservoir of steam, used to lessen the chance of pipe vibrations by the periodic cut off of steam and to supply a sudden demand of steam the receivers act as separators. These receivers and each section of the header are drained into a 3-in. drip main suspended below and run parallel with the header; from this the water is connected into a Holly receiver and returned, together with other clean high-pres-

sure drips, into the boilers by means of the Holly system. For the supply of the various pumps, a 5-in. main is carried along the partition wall in the basement of the engine room, this main supplied by a 5-in. pipe from each end of the main header. The high-pressure piping throughout is provided with the Vanstone joints with copper gaskets.

There are at present in the engine room two 500-kw electric generating units and a 1,500-kw unit and space for another 1,500-kw unit, making the capacity of the initial plant when entirely installed, 4,000 kw. The units consist of McIntosh & Seymour vertical cross-compound engines and General Electric three-phase, 60-cycle alternators, the alternator and a fly-wheel being located between the two cranks. The governing mechanism is of the interior fly-wheel type, under control of a ⅛ hp motor mounted on the wheel and controlled from the switchboard for moving the weights to the desired position and thus to secure facility in synchronizing. The smaller engines have 18 and 38-in. cylinders and a common stroke of 42 in., and the large engine 31 and 64-in. cylinders and 48-in. stroke. The alternators generate a voltage of 2,300 volts. Current is transmitted, at this pressure, throughout Cambridge, being stepped down by transformers at the points of use. The switchboard, which was built by the General Electric Company, is located against the outside wall of the engine room, and the conductors pass out of the building through a wiring tower, which is a small shaft built against a rear corner of the boiler room.

Each engine is provided with a receiver for the passage of the

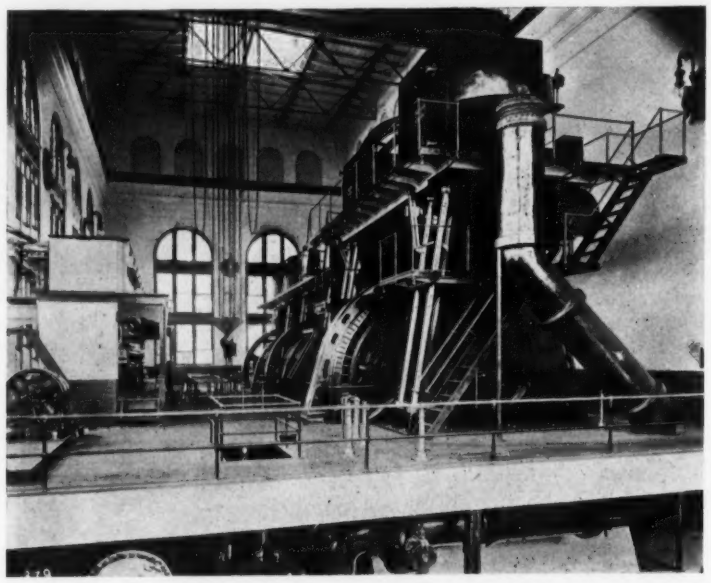


FIG. 3.—ENGINE ROOM, CAMBRIDGE PLANT.

steam from the high-pressure to the low- pressure cylinder, and the high-pressure cylinder is jacketed for high-pressure steam, and there is a high-pressure steam coil in the receiver. The condensation from each source is returned to the boilers by means of the Holly system. The exhaust steam from the low-pressure cylinder passes first through the main heater and then may be conducted to the atmosphere or to the condenser, the branch to the atmosphere having the usual back-pressure or relief valve for use when the condenser is in operation. The heaters were made by the Whitlock Coil Pipe Company, of Hartford, Conn.

The condensers are of the Blake vertical twin type of jet condenser, with 12-in. steam cylinders, 25-in. air pump and 18-in. common stroke, and 16-inch steam cylinders, 40-in. air pumps and 21-in. stroke. The reciprocating members rise into the engine room, and a light well has been built around them, giving considerable light to the basement in that way, in addition to that obtained from the basement windows. The condensers are located on the far side of the engine foundations from the boiler room and the main exhaust line is carried to the outside of the building independently of the exhaust from the pumps and auxiliary machinery. The exhaust piping throughout is of cast iron.

The condensing water is drawn from the Charles River through a tunnel to a well near the power house and from there through cast-iron injection pipes. The tunnel is circular in section, 4 ft. 6 in. in diameter, of 12-in. brick wall, and about 85 ft. long. Its inlet is protected with a grill of 1-in. iron bars, set vertically. The well is 8-ft. 6 in. in diameter, built with concrete walls 24 in. thick, and

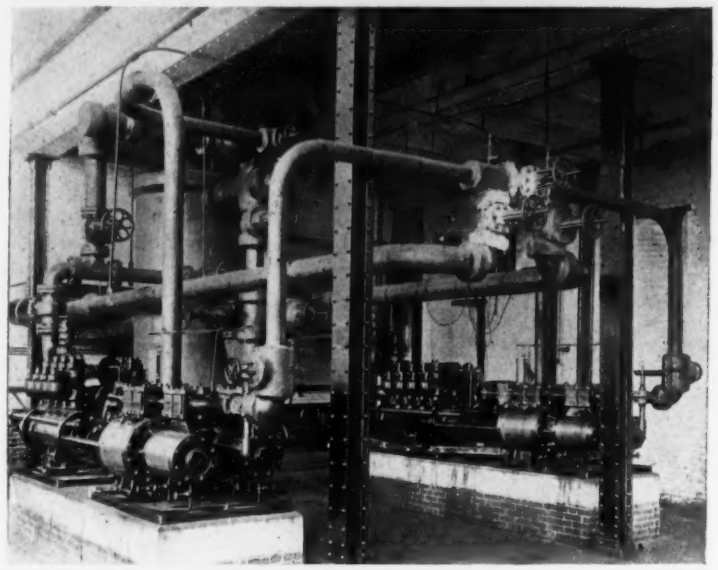


FIG. 4.—AUXILIARY STEAM PLANT.

capped with a cast-iron cover; it is about 23½ ft. deep. It is fitted with a partition of wood with a copper-wire screen in the bottom, the partition dividing the well into two compartments, one in which the screened water is taken through the enlarged mouth of the injection pipe and the other in which debris collecting outside the screen can be removed. The screen consists of ⅛-in. copper wire, with ¾-in. mesh and has a free area of about 14 sq. ft. The condensing water piping throughout is of cast-iron, and in the power house is carried in a cement-lined trench below the basement floor.

Besides the condensers and the boiler-feed pumps, which are supplied from the auxiliary steam main, there is a steam-driven ex-

FIG. 5.—GENERAL VIEW OF CAMBRIDGE STATION.

citer unit in the basement, supplied from the same source. This is intended to supply the field current for all three alternators, but when desired the field excitation can be obtained from a motor-driven exciter set in the engine room. This comprises an induction motor directly connected to a direct-current dynamo.

Feed water ordinarily is taken from a rain water tank and, when necessary, from the city water mains through a water meter. No purification or water softening has been found necessary. There are two feed pumps, situated, as stated, underneath the economizer, one the reserve of the other. These are of the Blake outside-packed plunger type, designed for high-pressure work. They deliver the water usually through the main heaters in the main engine exhaust pipes, then through the auxiliary heater, for the utilization of the exhaust from the pumps and auxiliary apparatus, then through the economizer and into the boilers. Any one of the heaters may be by-passed, as may also the economizer. The feed pumps are governed automatically by means of a pump governor. The by-pass around the economizer is extended into an independent boiler-feed main, while that from the economizer makes a second feed main. The auxiliary heater is of the closed type, of the same make as the main heaters.

An extensive oiling system has been installed for the generating machinery. It includes a duplicate installation of filters and oil tanks under a compressed air system of circulation. The equipment is located in the basement against the engine foundations and facing the basement windows. The oil tanks rest on brick piers on the basement floor and are 4 ft. in diameter and 3 ft. high with dished heads, the heads turned in the same direction. The filters, which are of the Cross make, are 35 in. in diameter, 4 ft. 4 in. high, supported immediately above the level of the top of the oil tanks. The compressed air is furnished by a motor-driven air compressor, and a compressed air tank 3 ft. in diameter and 6 ft. 9 in. long is provided, suspended from the basement ceiling. A 1-in. pipe leads from the air tank to the tops of the two oil tanks, with valves so that either tank can be put into use, and there is a branch to this pipe for filling with fresh oil. The oil is forced from the bottom of each tank through 1-in. piping to the lubricating system. On its return it is delivered by 2-in. piping into the filters and thence by a ¾-in. pipe into either oil tank to be recirculated.

The power plant was designed by Messrs. Sheaff & Jaastad, of Boston. The general contractor for the structure, including the chimney, was Mr. F. B. Gilbreth, of that city, and the contractor for the piping was the Walworth Manufacturing Company, of Boston. Mr. D. E. Badger is chief engineer of the plant.

Power Plant of the Ottawa Electric Railway.

BY JOHN MURPHY.

TO visit the power house of the Ottawa Electric Railway Company is to be impressed with the conviction that the company's street car system is a model one in every particular. While much could be said about the cheerful, bright and clean cars, the natty and polite employees and the excellent condition in which the whole equipment is kept, the purpose of this article is merely to describe that part of the system which so quickly excites public interest if it happens to get out of order—namely, the power station.

Before the memorable fire of April 26, 1900, which destroyed the greater part of Hull and a large portion of the city of Ottawa, the power plant of the Ottawa Electric Railway Company consisted of two hydro-electric stations containing five Westinghouse generators. Of the latter four were belt-driven, four-pole machines, and one was a twelve-pole, direct-connected machine. The combined output of the belt-driven machines was 2,100 hp, and the output of the other was 2,000 hp.

The two stations were situated side by side and either was capable of supplying energy for the whole service. The belt-driven generators were installed in an iron-covered frame building of exceptionally rigid construction and the more modern outfit was contained in a fire-proof brick and steel structure. The latter unit was intended to preclude the possibility of a complete tie-up in the event of an accident to the other plant, as well as to provide for extensions of the service, and while its installation was in progress one of the belt-driven machines, a 700-hp generator, was removed to the auxiliary steam station of the Ottawa Electric Company, about a quarter of a mile distant, where it still remains. The fire of April 26, 1900, completely destroyed the building containing the belt-driven generators, but the new station was practically uninjured. The steam station also escaped destruction, as it occupied a comparatively isolated position.

In the fall of 1902 a building was erected on the site of the destroyed station in which there was installed and there is now in operation, the largest storage battery in Canada. It consists of 288 cells of the Electric Storage Battery Company's latest improved "chloride" accumulators. The elements of the battery are contained in lead-lined wooden tanks, which have been made large enough to permit of a 50 per cent. increase in the number of plates and in the output of the battery. Each tank now contains twenty-five plates, but there is space in each for thirty-nine plates. The tanks rest upon porcelain insulators supported by well-seasoned pine

FIG. 1.—STORAGE BATTERY PLANT AT OTTAWA.

stringers suitably water-proofed, and the stringers are separated from the concrete floor of the room by vitrified bricks. This arrangement keeps the battery thoroughly insulated from the ground.

The maximum discharging and charging rates of the battery are 1,000 amp. and 350 amp., respectively. As the battery is thus able to take care of load changes amounting to 1,350 amp., and as the Ottawa Electric Railway's fluctuations in load are much less than this amount the generator load is an absolutely constant quantity.

It was only after a thorough canvass of the situation that the Ottawa Electric Railway Company decided to install the battery. The company foresaw that in the event of an accident to a water wheel, to a gate or to the gate-moving mechanism on their direct-

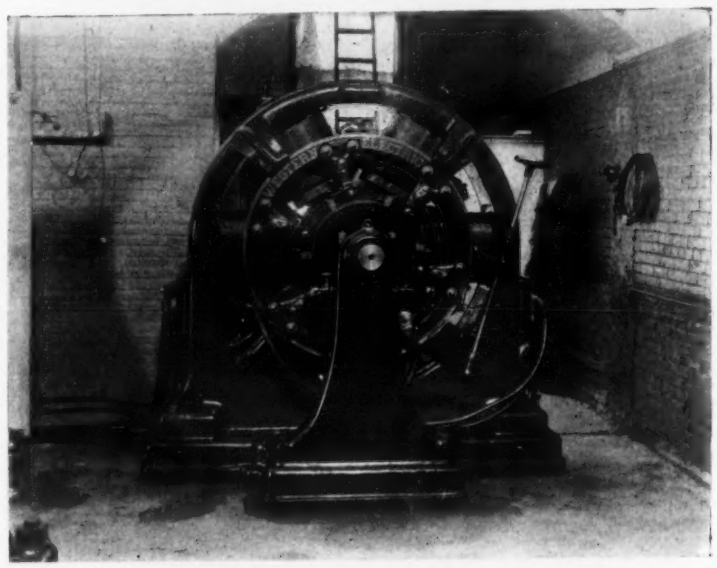


FIG. 2.—THE BOOSTER.

connected unit, their entire car service would be dependent upon the services of the 700-hp steam-driven generator, and to avoid such a contingency additional power plant became a necessity. However, before reaching a decision the question to be solved was this: Which installation would give the best results—a steam-driven generator, a water-driven generator, or a storage battery? The steam plant's first cost and expensive operation were serious bars to its installation, and the hydro-electric equipment's inability to render assistance at times when it would be most needed—namely, during ice or low-water troubles—had much to do with preventing its selection.

In the end the battery was decided upon, because it would immediately improve the service by maintaining constant e.m.f. at the power house, irrespective of load changes, and for the further reason that it would prolong the life of the hydraulic outfit not only by relieving the water wheels and gates from the jars occasioned by sudden variations in load, but also by saving the gate mechanism from being destroyed through its constant moving back and forth.

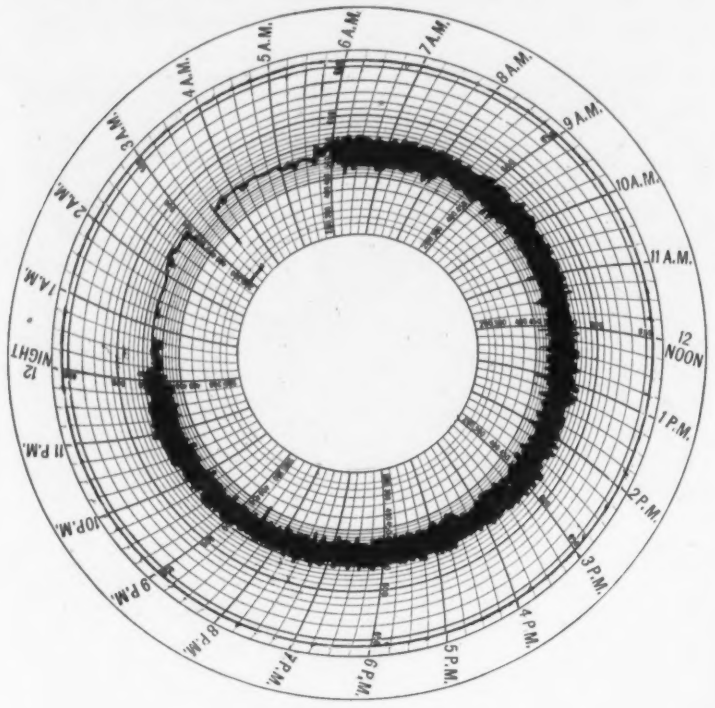


FIG. 3.—VOLTMETER CHART I.

A further and very important factor in determining the selection of the battery was that it would also act as additional plant. As is well known, street railway loads are of a fluctuating character, and peak hours exist. Thus it happens that between midnight and morning, battery charging can always be done and power thus stored during the night can be reserved for times of need. In connection with the generator at the steam station the battery is also

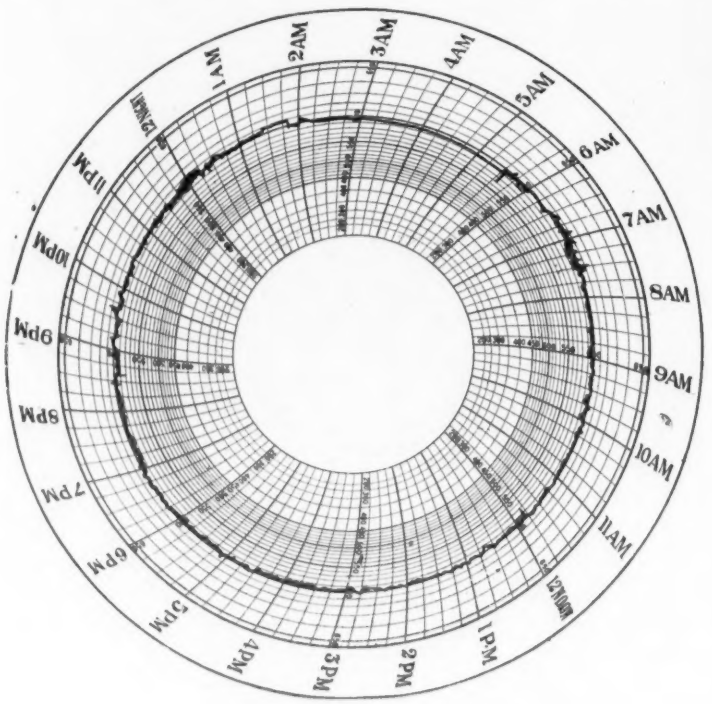


FIG. 4.—VOLTMETER CHART II.

able to take care of a respectable limited service. The beneficial results obtained from the Ottawa Electric Railway Company's battery during the past seven months are so apparent that the management have good cause to congratulate themselves on the wisdom of their choice.

Up to the time the battery was installed the water wheel speed and consequent generator e.m.f. was controlled by hand. The controller's efforts met with the degree of success which is illustrated by the recording voltmeter chart of Fig. 3. The 550-volt line was aimed at on this chart, but an average of about 520 volts was obtained, while sudden voltage jumps of 20 per cent. were not uncommon. Cars at distant points received about one-half normal voltage when the power house voltage dropped, because the consequent rise in current which accompanied the fall in voltage introduced abnormal line losses—the process being a cumulative one.

A glance at the chart of Fig. 4 will serve to indicate what the battery daily accomplishes in the way of regulating the bus-bar voltage and generator speed. In fact, a comparison of the charts of Figs. 1 and 2 is a valuable object lesson. Chart I was made before the battery was installed; Chart II afterwards. Chart I illustrates wide speed and voltage variations which occurred despite the constant efforts of faithful attendants to prevent them. Chart II shows what is now done automatically and without the slightest waste of energy in its accomplishment. Both charts were made by the same voltmeter connected across the power house bus-bars. Many lighting plants are operated to-day whose voltage curves would not favorably compare with that of the Ottawa Electric Railway Company's Chart II.

It will be noticed that the normal power house pressure is now 600 volts. The generator's speed and its field charge were both increased slightly to obtain this pressure. The pressure was raised

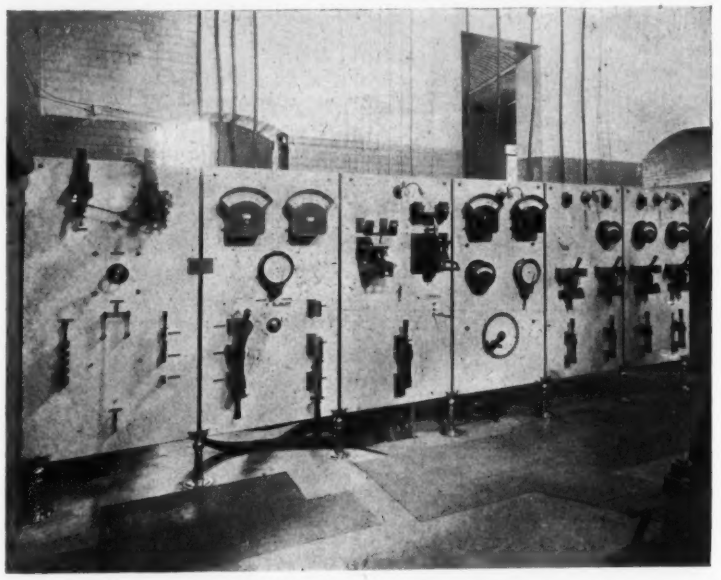


FIG. 5.—SWITCHBOARD.

to 600 volts for the purpose of obtaining the many benefits available when working at this pressure, and also because it was felt that the battery would hold the pressure constant at whatever point was decided upon. Chart II shows that a variation from the zero point of more than 1½ per cent. is a rare occurrence. The vim with which the cars now ascend grades and the way in which they spring to life when the motorman moves his controller, are among the most gratifying improvements that have followed the installation of the battery.

The reduction in the amount of current used per car due to the increased voltage is also a feature worthy of special attention. The power house current output, with the same number of cars in operation, has been reduced 40 per cent. The average amount of current used per car, based on power house indications, under old conditions was 28 amp.—it is now 17 amp. The reduction in line losses on this account is a most important matter, as it will postpone for a long period the necessity of increasing the feeders throughout the system. A differentially-wound motor-driven booster works in connection with the battery, and it makes the latter so sensitively active that an absolutely constant load is kept on the generator.

The water wheel gates are not moved at all for the purpose of speed regulation. The gates are opened far enough to make the

generator carry the average load, and the closest inspection of the tachometer fails to reveal any speed variation. A visitor could easily be persuaded that the generator was supplying an incandescent lighting service, so smoothly does it operate. An inspection of the line and battery ammeters, however, indicate that large and rapid load changes are always taking place.

The present plant, consisting of direct-connected generator and battery, is capable of supplying energy to a much greater number of cars than are ever used in Ottawa, and with the steam station a large amount of reserve power is always available. The illustrations represent the 2,000-hp, direct-connected generator, the booster, the switchboard, with the feeders cut off, and the battery room. It is interesting to note, in the switchboard picture, that while the battery and bus voltmeters' needles are reproduced quite clearly, the ammeter needles are not printed at all—the latter do not remain in one position long enough to be photographed.

Public Service Legislation in Massachusetts.

BY ALTON D. ADAMS.

GAS, electrical supply and railway systems are prominent objects of Massachusetts legislation in 1903. In general the character of most new legislation on these subjects is such as will increase the powers and privileges of the companies engaged in gas and electric service. Along with such increase, however, there is sure, in several instances, to be a larger degree of competition between public service companies.

Legislation tending toward an increase of competition in gas, electrical supply or transportation lines is rather against the established policy of Massachusetts, and the laws of the present year may be fairly said to be radical in this particular. It must be admitted, however, that these laws are not the result of any granger movement, or of any attack on public service companies as such; but rather to struggles between such companies themselves for public franchises. The fact is that Massachusetts presents so fertile a field for public service operations that companies engaged therein are often willing to extend their business even at the risk of competition. Along with the increase of powers and privileges some small additional burdens have been laid on gas, electric and street railway companies.

The tendency of gas and electric companies to extend their service areas has been favored in several instances by the Acts of 1903. Chapter 93 authorizes the North Adams Gas Light Company to extend its service into the town of Clarksburg, subject to the approval of the selectmen and the gas commissioners. Under like conditions the Pittsfield Coal Gas Company is authorized to supply electric light and power in the town of Dalton, by Chapter 159. The Edison Electric Illuminating Company, of Brockton, is given power, by Chapter 215, to extend its electrical supply into the town of Whitman, provided that consent of the gas commissioners and of the selectmen is obtained.

By Chapter 237 the mayor and aldermen of a city or the selectmen of a town through which the wires of a company are to pass are required to give the company a writing specifying the kind and locations of the poles, and the height at which the wires are to run. Any company, other than a street railway company, that desires to erect poles or fixtures along a public way, must apply, in writing, to the mayor and aldermen or the selectmen. The clerk of the city or town in which the locations are desired must mail notices three days before a public hearing on the petition of the company to owners of real estate along the public ways where the locations are desired. The fact that such notices were sent must be endorsed by the clerk on the specification of locations for poles and fixtures, and such specification is not valid without this endorsement of the clerk. After erection of the lines the mayor and aldermen or the selectmen may, after giving the company a chance to be heard or on petition of the company, may direct any alteration in the location of poles, and in the height of wires. All of these specifications and orders must be made a part of the city or town records. No permit is required for the renewal of poles once legally erected. This act is distinctly favorable to the companies in that it provides means by which the legality of pole and wire locations can be readily tested.

Chapter 417 authorizes the Boston, Brookline, Bay State, Roxbury, South Boston, Dorchester and the Jamaica Plain Gas Light Companies, also the Massachusetts Pipe Line Company, to combine in a new corporation to be known as the Boston Consolidated Gas Company. The provisions of this act are too extended to be discussed here, and those interested should refer directly thereto.

The most radical piece of legislation touching public service, for the year, is contained in Chapter 350, which empowers the Holyoke Water Power Company to generate electrial energy in Holyoke and South Hadley, and to sell this energy in all the cities and towns of Hampden and Hampshire Counties. Before sales can be made in a city or town the approval of the mayor and aldermen of the city or of the selectmen of the town must be obtained. Sales to any one purchaser may not be "in a quantity less than 100 hp at any time, nor until it has made with such purchaser a written contract providing that such purchaser shall use such electricity in his own business only, and upon his own property, except that it may sell to any city or town within the counties of Hampden or Hampshire which has established or may hereafter establish a municipal lighting plant, and any such city or town may purchase of said company electricity in any quantity and for any purpose for which said city or town can legally use the same."

The Supreme and Superior Courts are given jurisdiction in equity to enjoin the Holyoke Water Power Company from violating any of the provisions just named, or to enjoin a purchaser under one of the written contracts named from violating it, upon application of the mayor of any city or of the selectmen of any town in which the company may sell electricity. Wires and poles may be erected by the company subject to the provisions of the Revised Laws, and the company is generally subject to these laws except as noted. Unless the company builds a plant and engages in electrical supply within three years from the passage of the act, its rights thereunder cease. As to any city or town where the company does not engage in the sale of electricity the rights of the company shall cease at the end of ten years from the date of the act. This act may give rise to some interesting judicial questions. Though the company is authorized to *generate* electricity "for power purposes," the purposes for which it may be *sold* are not limited save as above stated. It may well be questioned, therefore, whether a customer of the company may not use the purchased energy for either power or lighting as desired. Though the "quantity" of electricity delivered to any one purchaser may not be less than 100 hp, the act does not state how many hours per day this rate of delivery must be kept up.

As is well known, the use of electrical energy for either power or lighting varies much as to its rate during the 24 hours of each day. It may, therefore, be a question whether the 100 hp named in the act must be the maximum, minimum or average load during the hours of daily use?

It does not appear that the mayor of a city or the selectmen of a town would have any interest in an injunction to restrain violation of the terms of the act as to the "quantity" of the electricity sold, unless the city or town has a municipal electric plant, but the courts are not given jurisdiction to grant an injunction to restrain such violation save on petition of these public officers.

The Holyoke Water Power Company owns the entire water power development of the Connecticut River at Holyoke. Large amounts of water power are now sold to manufacturers in Holyoke, and the act just considered makes it possible to transmit other large amounts of power to cities and towns within the counties named. Among these cities and towns are Springfield, a few miles down river, and Northampton, a few miles up river from Holyoke, besides dozens of smaller places. Electrical supply companies in this territory will watch the development of the water power transmission from Holyoke with no little interest.

Chapter 406 makes certain changes in the Revised Laws as to the returns that gas and electric companies are required to make to the gas commissioners. By Chapter 319 it is made an offence for any public service corporation to appoint or discharge any person at the instance of any employee of the government of the Commonwealth or of any county, city or town, from the Governor down. It is a like offence for any public officer to make any request relative to the employment or discharge of any person by a public service corporation. The same offence is committed by any person who makes use of any official request in an effort to obtain employment with a corporation engaged in public service. The fine to be imposed alike on any person or corporation guilty of this offence is not less than fifty nor more than one hundred dollars.

In Chapter 164 it is provided that, when a company engaged in the distribution of gas or electricity refuses to supply any person

having a residence or place of business in a city or town where the company is so engaged, the gas commissioners, on petition of such person, may issue an order to the company to begin such supply on reasonable terms, after notice to the company to appear and show cause why the service should not be rendered.

The Revised Statutes provide for municipal gas and electric plants in certain cases, such plants to be paid for and owned by an entire city or town in each instance. In Chapter 221 a further step was taken by authorizing the Miller's Falls Water Supply District in the towns of Montague and Irving to establish an electric plant. This plant is to be owned and managed by the district and not by the towns.

Another extension of municipal activity was authorized in Middlefield, where the town had previously voted to build a telephone line. By Chapter 418 the appropriation of money for this purpose by the town was ratified.

In the charter of the Huntington & Westfield River Railway Company, Chapter 346, it is provided that any of the eleven towns in which the tracks of the railway may be located may subscribe to its stock or bonds. This company is authorized to own water powers and to transmit and sell electrical energy to electric light companies and to other street railways.

Five electric railway corporations, whose lines connect the cities of Lowell, Lawrence and Haverhill with points in New Hampshire, were authorized to consolidate by Chapter 409. The new corporation, the Northern Massachusetts Street Railway Company, was given authority to issue stock to an amount equal to the par value of the capital stocks of the five consolidating companies, and to exchange its stock for the stocks of these companies. After this consolidation is completed the act provides that the Northern Massachusetts Street Railway Company may lease its railway to the Exeter, Hampton and Amesbury Street Railway Company for a period of not more than ninety-nine years. This consolidation and lease are subject to the approval of the railroad commissioners.

Under Chapter 297 every street railway company is required to notify the medical examiner of the county, who resides nearest to the place of a fatal accident on its road, of that accident immediately. The company is also required to notify the railroad commissioners of any accident, concerning which these commissioners may require notice, within 24 hours after it occurs.

A special and learned commission appointed to consider the subject of street railways in Massachusetts a few years since decided among other things that the proper place for a street railway is in the streets. In spite of this well-considered opinion, which is of course shared by steam railways, the street railways persist in locations on private land for large sections of their lines. Heretofore the street railways have been at a disadvantage in Massachusetts because they could not exercise the right of eminent domain without a special grant from the Legislature, which was hard to get. As a result street railways have been forced to purchase private rights of way on the best terms they could.

Chapter 476 of the present year will serve as a partial remedy of this difficulty. This chapter provides that a Massachusetts street railway company may take land in a city or town for its tracks after approval by the Board of Aldermen in the case of a city or the selectmen in a town, the further approval of the railroad commissioners, and after a public hearing at which those interested can be heard. Such taking of land is further regulated by sections of the Revised Laws that refer to the taking of land by railroads.

The most important piece of legislation touching public service that was enacted during the session is found in Chapter 202, which authorizes street railway companies to act as common carriers of baggage and freight. This calling may be exercised by a company in any city or town when, after a public notice and hearing, it has obtained the consent of the Board of Aldermen of the city or of selectmen of the town, and also a certificate from the railroad commissioners that public convenience requires the service. Street railway companies are made subject, as to their carriage of baggage and freight, to local regulations of the aldermen or selectmen that have the approval of the railroad commissioners. The general laws relating to common carriers are also made applicable to street railways.

Legislation along this line has long been sought by the street railway companies of Massachusetts, and has as long been opposed by the steam railroad interests. In a few instances individual street railways have been grudgingly granted the privilege to carry small parcels, or a particular kind of freight such as coal or farm produce, or even ballast for their own tracks. One street railway charter, of 1902, granted the full powers of a common carrier.

Now comes the present general legislation, and the battle for the rights of street railways in the carrying business is in large measure won. Boards of Aldermen and selectmen will not be slow to give the public the benefit of street railway competition with steam roads in the carriage of freight. The railroad commissioners will fall below their past standards if they fail to see that public necessity and convenience generally require street railways to act as common carriers.

Professor Wilhelm Ostwald.

Professor Wilhelm Ostwald, of Leipzig, the famous German chemist, returned to Europe this week after a short visit, during which he opened the newly-built biological research laboratory of the University of Californinia, by an address delivered in German. As is well known, Prof. Ostwald represents with Van't Hoff and Nernst, the highest authority in modern physical chemistry and electrochemistry. But while Van't Hoff is most famous as a worker and thinker along the most advanced theoretical lines, and Nernst is known to every electrochemist through his theory of solution-pressure, which has proven of immense value in the understanding of electrolytic processes, and to the broad public through the Nernst Lamp, Ostwald has been perhaps of more indirect but further reaching influence through the great number of his books and publications, which have really enabled the modern chemical and especially electrochemical views to become popular and recognized. Ostwald might justly be called the father of modern chemistry, not only because his books have had the very greatest influence in spreading this science, but mainly because no other physical chemist can look upon such a host of well-known and even famous pupils. Thus Nernst and Arrhenius proudly call themselves his pupils, and among our own better known men we may mention Profs. A. A. Noyes, W. R. Whitney and H. M. Goodwin, of the Massachusetts Institute of Technology; Prof. T. W. Richards, of Harvard; Profs. W. D. Bancroft and J. E. Trevor, of Cornell; Profs. M. Loeb, of New York University, and T. L. C. Morgan, of Columbia; L. Kahlenberg, of Wisconsin and H. C. Jones, of Johns-Hopkins. There is, indeed, scarcely a single one of our large universities which does not have one of Ostwald's pupils on its teaching staff.

The electrochemist in particular is indebted to Ostwald for his great work on electrochemistry, which is undoubtedly the best historical book ever written on this subject. It contains a critical review of all theories and publications bearing on this subject up to the year 1896. Were it even for this alone Ostwald's name would be gratefully mentioned; but it represents only a very small part of his activity along electrical lines. His investigations and those of his pupils were fundamental in establishing the theory of electrolytic dissociation, on which rests our modern views of electric conduction in liquids. His text-book on "General Chemistry," in two volumes, published in 1884, was followed in 1889 by the "Outlines of Physical Chemistry"—the so-called "small Ostwald"—and finally by the inexhaustible fund of practical laboratory methods and hints in the "Hand-book for Physico-Chemical Measurements," published in 1893, which can be found in the library of every well-read student of modern chemistry. Through these and through the *Zeitschrift für Physikalische Chemie*, founded by him in 1887 and edited since with the assistance of Van't Hoff, Ostwald has succeeded in carrying modern chemical views into all branches of natural sciences—into physics, physiology, medicine, biology. And it seems a significant recognition of this that Prof. Jacques Loeb, known to everybody through his wonderful work on the parthenogenesis of fish eggs, has selected Ostwald to open the new laboratory of biology at the University of California.

The publications as mentioned so far give but a very inadequate idea of Ostwald's tremendous activity. Since 1889 he has published the famous "Klassiker der Exacten Wissenschaften," generally known as "Ostwald's Klassiker" series. What popularity they have gained and how large a demand must have existed for such publications is readily seen by the fact that the 200th volume will soon be reached. The list includes classics of the great scientists of the past who, being in advance of their time, had been overlooked and forgotten, until re-discovered by Ostwald and saved from oblivion. We Americans have particular reason to be thankful in this

respect since it was through him that one of our greatest scientific thinkers was saved from the fate of dying unrecognized and not understood. In 1892 Ostwald translated into German the "Thermodynamic Studies" of the late Willard Gibbs, of Yale, whose beautiful and wonderfully comprehensive studies were in danger of being buried and lost in the *Transactions* of the Connecticut Academy. The attention of the scientific world was thereby drawn to them, and the curious thing happened that every scientist in Germany thus knew of a man who has not been fully appreciated to this day in his own country.

Ostwald's epoch-making book, "The Scientific Principles of Analytical Chemistry," appeared in 1894, and two years later all of his experimental researches together with those of his former pupils published while working under his direction, were compiled into four voluminous books entitled, "Arbeiten des Physikalisch-Chemischen Instituts der Universität Leipzig." It must be remembered that he was busy during these same years on his afore-mentioned great compilation, "Electrochemistry," and that in order to appreciate his tremendous capacity for work one must have read his innumberable abstracts and criticisms of contemporaneous literature, scattered through the forty odd volumes of the *Zeitschrift*. We must further extend the long list of his books by his "Outlines of Inorganic Chemistry" of 1900, and his very latest book, which was

PROFESSOR WILHELM OSTWALD.

put on the market only a few weeks ago, his "School of Chemistry." Through these two books he aims at revolutionizing the very methods of teaching chemistry in a way which has been urged repeatedly in our schools, namely, by forcing the student to observe and to draw logical conclusions instead of telling him facts which he must take for granted. But Ostwald attacks the problem in so original a way and develops it so logically—one might say even playfully—that his book is bound to attract the greatest attention, since it surpasses all other attempts along similar lines.

But a nature so manifold and rich as Ostwald's seeks activity far beyond the limits of its own field. In the spring of 1901 Ostwald surprised his colleagues and his students by the announcement of a course of lectures on Natural Philosophy, which aroused the greatest interest and made it necessary for him to use the largest lecture-room in the University. These lectures were collected in his "Vorlesungen über Natur-Philosophie," a book which has had a very favorable reception in general, for no matter whether one's ideas agree with those of Ostwald, everybody will find in them a great many novel and delightful aspects. The ideas expressed therein have since found a new advocate in the *Annalen der Naturphilosophie*, a monthly journal published by him since December, 1902.

Americans are apt to believe that the man of science is not a practical man—that he helps but little or at least but indirectly to solve the important problems of everyday life. The success of men like Edison and many other great inventors seems to give support to the view generally held that practical men without scientific training preserve a keener eye for practical needs. It is useless to argue the question where the greater advantage lies when we consider the possibilities of application which present themselves to the man who is a leader among those who try to solve the mysteries of science with a complete mastery of our present scientific apparatus. The inventions of such men are apt to be more ingenious and revolutionary in their nature, while those of practical men produce, as a rule, improvements of known methods but not anything strikingly new in fundamental principle.

Now in Ostwald's case, we find the truth of this well illustrated, for his studies in the mysterious reactions grouped together under the so-called "catalytic reactions," have led him to devise a method of reproducing pictures, drawings, etc., which is attracting the greatest attention abroad, since it is absolutely independent of the action of light. The "Katatype" process promises to revolutionize all of our photographic printing methods, not only because it makes possible to print photographs in the dark, but mainly because it renders unnecessary the employment of the expensive silver bromide emulsion.

Ostwald's other important invention concerns the production of nitric acid from the inexpensive ammonia obtained from gas factories in large quantities. This promises to make German agriculture and the German army independent of Chile, which to-day furnishes by far the greatest portion of the valuable nitric acid in form of nitre.

Prof. Ostwald was born on September 2, 1853, in Riga (Russia), where he was graduated from the Gymnasium in 1872. From '72-'75 he studied Chemistry and Physics in Dorpat, now known as "Jurjew," and after attaining the degree of Bachelor of Arts, he became assistant in physics. Meanwhile he took his master's degree in 1877, and in 1878 the degree of Ph.D., when he was made assistant in chemistry in 1880 and professor in 1881. In 1887 he was called to Leipzig to fill the newly-created chair of general and physical chemistry, and since 1898 he has been director of the famous Institute which has been built entirely after his own plans, and which has served as a model for similar institutions. It is interesting to note that the California physico-chemical laboratory is an almost exact reproduction of Ostwald's institute. Upon his return from California and after a short visit with some of his former pupils, Prof. Ostwald was compelled by his engagements in Europe to return hurriedly, but expects soon to make another and longer visit.

Proposed Charter for Denver.

The proposed charter of the city and county of Denver, Colo., which was prepared by the recent charter convention, possesses several clauses of interest to public utility corporations. The charter is to be voted upon September 22, and a vigorous campaign is now on between its adherents and opponents. In general the local street railway, the steam railroad and other public service companies have expressed their opposition to the charter, claiming that its adoption would tend to have a restraining influence on all extensions of existing rights, and on the granting of new franchises. Gen. Irving Hale, Denver, representative of the General Electric Company, an electrical man well known throughout the country, was president of the charter convention, and the only engineer among the members. He would, therefore, naturally have been consulted to a great extent in the consideration of any clauses affecting general electrical and engineering matters. However, soon after the convention began its deliberations, he was taken seriously ill, not being able to return until ten days before the adoption of the charter by the convention. During these last few days his presence was evidenced by the striking out of some of the more obnoxious features of one or two clauses that had been previously adopted. One of these was a section providing that all poles and overhead wires in the business portion of the city should be removed and the wires placed underground within five years, and, in the rest of the city, within ten years. This meant the changing of the overhead trolley system of the Denver City Tramway Company to an underground conduit system. Gen. Hale was successful in explaining that this would place an unreasonable and too expensive obligation upon electric companies operating in a city the size of Denver. So the street railway system was exempted from this rule and the provision for placing all other wires underground was limited to the business section.

Another section that was adopted empowers the city council to make reasonable regulations concerning the operation and use of all franchises, and to fix reasonable maximum charges for water, light,

telephone service, street railway fares, and other public properties. This clause was combatted by a number of the members of the convention, on the ground that a body of men such as would compose the city council was not competent to regulate and fix rates which vitally affect the operation and successful existence of public corporations, and that such power is liable to be used for blackmailing purposes. They did not succeed in having this section altered, the motion to reconsider being lost by a tie vote.

The proposition to submit to the voters at an early election the question of the city buying the Lacombe electric street lighting plant came up for considerable discussion. Under its franchise the city has the right to purchase this plant any year at a specified price, but convincing figures submitted showed that if the plant were purchased, its annual operation, including fixed charges and depreciation, not properly considered by the committee, would cost the city more than it is now paying the company for the street lighting furnished, and the convention decided that it would not pay to consider the proposition.

Another important matter accomplished was to limit all votes regarding installation and purchase of public utilities to tax paying electors, instead of to all voters.

A section of the new charter, naturally objected to by the friends of the Denver City Tramway Company, is one requiring all slots and conduits heretofore used for cable street railway purposes, to be removed within one year from the adoption of the charter. The tramway company has about twenty-eight miles of this cable track construction, a considerable part being on paved streets. In this track fifty-six-pound girder rails are used with special clamps bolted to the cable yokes. To remove the conduits and to substitute T rails for the cable rails would necessitate a heavy and apparently unnecessary expenditure on the part of the company.

A Report Against Cleveland, O., Municipal Plant.

The board of directors of the Cleveland Chamber of Commerce have adopted the adverse report of the special committee on the proposed municipal electric plant for that city, the committee being T. H. Hogsett, E. J. Blandin and Amos B. McNairy. The report discusses figures presented in favor of the plant by Messrs. Bemis and Phelps, already noted in these columns, and pronounces them incorrect, saying further that "so important a step should not be taken by the city of Cleveland upon an investigation superficial and confessedly inaccurate." The report cites specific omissions and errors. The conclusions of the committee are as follows:

1. That the chief and practically the only reason urged by the city authorities, for taking the taxpayers' money to enter a competitive business is, that the city ought to be able to supply electricity to the citizens and light its streets cheaper than can be done by a private company. The experience of city governments generally throughout this country shows that municipal business is not conducted as economically or efficiently as private business, and that the authorities have no substantial ground on which to base their declaration that the city can manufacture and sell electricity cheaper than the private company.

2. The rates of the private company are not unreasonable, but on the contrary are lower than those made by similar companies in several American cities of a size comparable with Cleveland. But even if they were unreasonable your committee holds that the way to correct them should not be for the city to hazard the taxpayers' money in the dangerous experiment of building and operating a competing plant. Regulation and not ownership is the safe policy for the city and the city has complete power to regulate the rates and practices of any local lighting corporation. Wherever their rates are excessive they can be made unlawful, and reasonable charges established. Whenever their services are below a proper standard of quality or their methods oppressive or unjust the necessary corrections can be required by law.

In fact, without risking a dollar of the city's credit or adding a mill to the tax rate, the city can accomplish all that is possible through a municipal lighting plant, except to require that the business of supplying electric light and power to the citizens of Cleveland, shall be conducted at a loss.

3. It is not necessary for the city to take taxpayers' money to build and operate its own electric plant, in order to secure the reduction in cost of electricity that comes through the development of the art. The reduction made by the private company in the price per lamp per year for street lighting from $94.80 in 1896, to $75.00 in 1903 shows conclusively that the city has shared in the economies resulting from improved machinery and consequent lower cost of production. It ought not to be forgotten in considering this project that the business of supplying electricity is still in a developing state, and subject to rapid modifications through new discoveries. The most efficient machinery of one day may be rendered obsolete by the inventions of that following. The changes in machinery and methods are at times exceedingly costly and their expense can not be calculated in advance.

Under the contract system the risk of loss from this source is borne by a private corporation, and no part of it falls upon the taxpayers. With a municipal plant the entire burden would have to be borne by the city.

4. The errors and omissions that have been developed in the original estimates of Engineer Phelps and the statement submitted to the council on May 3rd, by Superintendent Bemis convince your committee that the council passed the original bond ordinance under an entire misapprehension of the facts. Your committee is compelled to conclude that, whereas the council authorized a bond issue of $200,000 and was led to believe that a further estimate of $200,000 would complete the plant for the West Side and furnish electricity for the public buildings on the East Side, the analysis of Mr. Phelps' statement shows that $500,000 would be a conservative estimate of the cost of the work now proposed and yet this is only the beginning of the undertaking as outlined by the city authorities to thoroughly cover the West Side territory, not to mention the vastly greater work of covering the territory on the East Side.

5. It is unjust to taxpayers to force them to pay extra taxes and invest these (also mortgaging the city's credit and indirectly every dollar's worth of local property) to go into a business venture which can only supply a small portion of the city's population and is very likely to run at a loss. Therefore your committee is strongly of the opinion that the bonds issued by the city for a municipal lighting plant should be a lien upon the plant only and not upon the entire assets of the city; and the payment of the principal and interest of such bonds should be provided for out of the net income from the plant. In this way the users will stand all the cost of supplying them with the service, and it will not throw part of the cost on taxpayers who are non-users.

The bids for such bonds would be a fair index of the confidence which investors have in a municipality's ability to conduct a business successfully. To issue bonds in this manner is not now allowed under the statutes; but your committee feels very strongly that if the city is to be committed to this undertaking at all, such action ought to be postponed until laws can be secured which will make it unnecessary that it should pledge its general credit for the purpose.

6. There is vital need in our city for a number of public improvements. At the same time there is a limit to the debt that our taxpayers can be called upon to bear. This necessitates a selection of the improvements to be pressed at this time. The city authorities evidently give precedence to the lighting plant, but your committee cannot concur in their decision. The city's need for pure water is far greater than for cheaper electric light.

The State board of Health is authority for the statement that our citizens are dying as a result of the existing condition of the water supply. The most ardent advocate of the municipal lighting plant cannot claim that the citizens have so much as asked for its construction.

If the city authorities are prepared to spend $500,000 for a municipal improvement on the West Side, it would be of inestimably greater advantage to our citizens to spend it in connecting the old water intake with the new intake, so that the West Side may at least have as good water as the East Side, than to risk it in an attempt to furnish electric service at a less cost. Probably most West Side citizens would also agree that the value of property on the West Side would be increased and the

convenience of its citizens subserved much more by an additional viaduct than by electric current furnished by the city.

There are few if any of our citizens who will argue that a municipal electric plant duplicating good service already in existence should take precedence of sewers, parks, public buildings, improved harbor facilities, better fire protection or any one of several other municipal improvements for which the same amount of money might be spent.

7. The length of this report precludes the discussion of other subjects which might well be considered in connection with the proposed lighting plant, such as the question as to whether the merit system will govern in the employment of the necessary help; the question as to the advisability of restricting the field for individual initiative; the question as to whether our city departments are now being so well handled as to make the public eager to increase them; and many other questions that would furnish profitable fields for investigation and discussion.

8. Taking a broad view of the proposition the conclusion of your committee may be expressed in a single concrete statement. A tax is a compulsory contribution from a person to the government to defray expenses incurred in the common interest of all. The proposition under consideration is a proposition to levy a tax that is not for the common interest of all, but which has reference to the special benefits to be conferred on a comparatively few, namely, the users of the city's commercial lighting service. Therefore, it involves an improper use of the taxing power.

9. Finally, in closing this report your committee feels it to be only its duty to state that, after careful investigation it is at a loss to understand why this project to build a municipal electric plant should be brought forward by the city authorities at this time; and, your committee has been unable to obtain from the authorities themselves any sufficient reason for this improvement being advanced over others that are unquestionably of far greater importance to the health and general welfare of our citizens.

10. The recommendation of your committee therefore is that the board of directors of the Cleveland Chamber of Commerce transmit this report to the City Council with the earnest request that it be given consideration, in the belief that upon further investigation of the proposition to establish a municipal electric plant the Council will clearly perceive the inadvisability of proceeding with the project.

The Right of Way.*

BY H. H. VREELAND.

IT has always seemed to me, when the question of the right of way of street cars has been under discussion in our societies, that it has been approached from the wrong point. This defect in the discussion seems to arise from a lack of clear statement of what is meant by "right of way." Street railroads, in the sense that steam railroads enjoy this privilege, have no "right of way." A steam railroad operates along a strip of land, owned in fee, which it holds and uses for its special purposes against all intruders, and it can only be obstructed by trespassers. The case of a street railway is entirely different. It has a franchise to go along a rigid and appointed route on thoroughfares which are used in common by pedestrians and vehicles of every description.

This being the case, the question of "right of way," in so far as it is applicable to street railroads, becomes one not of right of way, but of precedence, since the general public has equal rights on the road. These roads or streets being dedicated to public use, it is the duty of the authorities to see that they are so policed as to obtain for the greatest number of people the fullest and freest use of the facilities which they afford. If street railroad men would view the topic from this point of view and insist that the streets are for the use of the people instead of corporations or individuals, the whole question, in a short time, would take on a different aspect. A railroad company is permitted primarily to exist, not for the aggrandizement of its owners or operators, but for the accommodation of the public. An individual citizen who enters and pays a fare does not thereby relinquish any of his rights to free passage along a public street, and there is hardly an hour of the day or night in which he can enter a car or a street anywhere in a city without finding company, so that the vehicle in which he rides represents not only his individual right, but the assembled rights of all his fellow passengers; and so it has always seemed to me, viewing the question from the standpoint I have indicated, that a crowded car, full of people, should, by mere preponderance of the number of individuals it contained, have a superior right of passage to a vehicle with a single individual in it, or to a van containing merchandise. If, before public bodies, it was unanimously insisted by railroad men that the reason they demanded "right of way" was because of their passengers, I think it would disarm much of the resistance which has met the attempt to secure police co-operation.

A good analogy between the rights which all street railroad operators claim for their vehicles is to be found in the rules of the road concerning United States mail vans. These have the right of way everywhere, and it is a misdemeanor to obstruct their free movements. The reason of this is not because the wagon is labeled "United States Mail" or because of any superior authority vested in the driver, but because the vehicle contains hundreds—it may be thousands—of business communications involving complicated business interests. For the same reason, I have always held that a street car containing a crowd of people—necessarily in haste or they would find a cheaper and more leisurely way of reaching their destination—had rights superior to other vehicles on street surfaces.

Added to all this is the fact that these public conveyances are restricted in their movements to a fixed way, whereas the others, in addition to being lighter and more easily moved, have a flexibility of route denied to tramcars.

*A paper read before the Saratoga meeting of the American Street Railway Association.

Mr. Yerkes on Inflammable Underground Cars.

In a letter to the *London Times* on cars for underground service, Mr. Yerkes writes: "Cars have been run in the open for many years, and the custom of building the ordinary car has been followed for underground systems, as well as for surface lines. If a car takes fire on the surface, there is plenty of good air for the passengers to breathe after they have alighted from the car, and there is little danger of their being burned before they can vacate it. Under ground, however, the conditions are entirely different; therefore a different system of manufacture of cars must be practised.

"I would say that it is a very rare occurrence for a car to be set on fire directly from a motor. Fires occur from a short circuit in the wire connecting the motor with other parts of the train. These wires are run under the body of the car, and where there is anything wrong, like a faulty splice, which is generally the cause of fire, ignition of the woodwork which surrounds the arc must certainly take place. Iron tubing is no protection whatever. If an electric wire be covered with rubber or other non-conducting material, placed in an iron tubing, and a short circuit or arc be formed, by the separation of the wire, the iron tube will be melted, and it will disappear the same as though it were so much paper. Asbestos or its compounds will be burned or destroyed wherever exposed to the arc, and I know of no substance that will withstand the heat of an electric arc. In my opinion, non-inflammable wood, properly treated—and it can be properly treated in London—is the best material that can be used. Holes can be burned in it, as they can in iron, but it will not blaze or smoke. We have samples of wood that have been tested, and the result has always been the same. What is most desirable is a car that will not burn; in fact, there should be no portion of it that can create a smoke, for this smoke is more fatal than the flame itself. The flame cannot carry far, but the smoke permeates every crack and crevice. Another thing that I believe is most important is a system of ventilation that would force air into the tunnel and draw the smoke or foetid air from it. There is not the least difficulty in making our tunnels and tubes perfectly safe, indeed even more so than those

railways whose carriages are running on the surface, from the fact that where there is nothing to burn it is impossible to have a fire; and that is what we must have in the tunnels, not only the cars, but the stations, and every particle of wood that goes into them, no matter how small or unimportant, must be so treated that it cannot burn."

Recent Steam Turbine Developments.*

By W. L. R. Emmet.

WHEN the writer agreed some months ago to present a paper to this meeting he fully expected that its subject-matter would mainly consist in a record of practical results accomplished with commercially operating machines and that such matter would be full enough to justify its presentation and discussion. Some months ago a paper was presented to the American Philosophical Society on this same subject which has since gone the rounds of the press. This paper dealt at some length with our expectations concerning the new steam turbine developments now going on at Schenectady, but gave no actual results other than those produced by a single 600-kw machine which has been operating for some time at Schenectady, and which is different in many respects from the machines now being built.

The scant array of established facts in this paper and the rather liberal presentment of expectations have called forth some criticism, particularly from European turbine builders. Such criticisms are not unnatural under the circumstances, and we are naturally eager to demonstrate to the world the soundness of the claims upon which the General Electric Company and its customers have based such large undertakings.

The writer had confidentially expected that before this date the 5,000-kw turbine recently installed at Chicago would have been fully tested and verified and that its results could be here presented to the members of this Association who are so deeply interested in the success of developments of this kind. We have fallen a little short of this expectation through such unforeseen delays as are usual in such cases, but still have produced results which are highly interesting and suggestive, although no complete tests have yet been made. The machine has been installed in the new station of the Commonwealth Electric Company, which is probably the finest and best-equipped station in the world, and has been connected to its regular equipment of boilers and condensing facilities. It has been started without any hitch or delay and has been operated repeatedly at full load and under a variety of conditions to test its performance. It has operated with a wonderful steadiness and perfection, has governed perfectly from full load to no load with only 2 per cent. speed variation and has in every respect shown itself to be a thoroughly desirable operating machine. A test of steam economy was also very carefully conducted on this machine, very perfect facilities for weighing water and maintaining a steady and accurately measured load having been provided. Unfortunately, the results of these tests were found afterwards to be entirely indefinite since a large leakage of circulating water, through a misplaced valve, into the steam space of condenser was discovered, which water had been weighed in connection with the condensed steam. When this was discovered it was too late to ascertain with certainty the amount of this leakage at the time of test. The flow with no load, however, indicated that this leakage was very large and the general inference drawn from our test is that a very fine steam economy was shown. We will, however, refrain from making any positive statements on this subject until we have obtained tests which are absolutely unquestionable.

All the conditions in connection with the running of this machine have given very favorable indications. The machine is connected so that the condensed water passes from the hot well through a heater and is pumped directly back into the boiler. This whole system was in operation and worked perfectly. The water returned to boilers was, of course, entirely free from oil and quite clear except at light load when the leakage from river water appreciably discolored it. The plant operated at full load with four 500-hp boilers fired out of the eight which have been provided for each machine. These boilers were fired with Illinois coal on chain grates, and their performance of the work is in itself an indication of good economy.

*A paper read at the Saratoga meeting of the American Street Railway Association.

After this test run the machine was taken apart for the purpose of making a minor internal change which was thought to be desirable. The machine will not be required for service for some months, and our desire is to get it in the best possible condition in advance of the time when it will be required to carry a large winter load. The machine will probably be ready to run again within about a week or ten days and conclusive tests will then be made.

In order to properly understand the significance of the successful starting of this machine, it is necessary to review the history of its design and to compare it with engines of other types. After the experiments with Mr. Curtis's steam turbine inventions had proceeded for several years, certain experimental results were obtained which seemed to justify the production of commercial machines, and it was decided to build a commercial machine for use in the Schenectady Works. A 600-kw machine with horizontal shaft was designed, the mechanical arrangements being in most respects in accordance with the plans which Mr. Curtis had formed previous to that time for building the turbines. This machine was built and tested nearly two years ago.

These tests showed a high steam economy, and it was very soon decided that the performance of this machine justified the building of other commercial machines which could safely be relied upon to perform as good or better results. The question of mechanical design for these larger machines then became a matter of first importance. The steam economy could safely be expected to conform closely to that of the machine which had already been tested, but the whole question of cost and commercial desirability depended upon the mechanical construction adopted for accomplishing the desired results.

It was decided at this time to build a steam turbine unit as large as the largest engine driven generating unit in the country, and as the result of this decision the design of the machine now in Chicago was made up after a great amount of thought and study. This design embodied many very radical features as compared with other engines, turbines or machines of any character. The shaft is vertical; the whole weight of the revolving part is borne by an oil film delivered by a pressure pump to the lower bearing; the delivery of steam to turbine is controlled through a system of electrically operated individual valves worked by a small controller something after the manner of multiple unit train control system—a centrifugal governor moving the controller. The revolving field is mounted upon the same shaft with the turbine wheels, and the stationary portion of the generator is supported by the stationary portion of the turbine, the whole building up into the general form of a vertical cylinder about 25 ft. high and about 14 ft. in diameter. The total weight of the turbine and generator is about 400,000 lb. and its capacity is 5,000 kw at full load. It is capable of running at about 75 per cent. overload condensing, and at nearly full-load non-condensing.

The question as to why the vertical shaft design was adopted for this unit has often been raised and many doubts and criticisms concerning it have been expressed. It is not easy to explain all the reasons which lead up to its adoption but it may be said that the compactness and simplicity of this unit, which are its most marked characteristics, are largely due to the merits of this design. With the vertical shaft arrangement all lateral strain is removed from the bearings which align the shaft and all deflection of the shaft is avoided with a minimum number and length of bearings. This matter of properly supporting a shaft and keeping it exactly central and in perfect alignment is an important one where small clearances are desirable with a large diameter in the revolving part. To carry such weights as are necessary in the revolving part of this large unit many very large bearings would be required if the shaft was in a horizontal position. An elaborate system of forced lubrication with artificial cooling would be necessary in connection with these bearings, and a failure of any of these bearings would occasion serious danger to the operation of the machine. If the machine were built in a horizontal position it would be very difficult to so support the wheels that their clearances would not be affected by sagging of the shaft or looseness in bearings, and also, it might be difficult to place them with such a relation to each other that the clearance would not be affected by expansion of the shaft. In the vertical design the space between wheels is reduced to a minimum, the supporting structure is perfectly symmetrical and cannot be in any way distorted or put out of line either by mechanical or steam pressure strains or by the effects of expansion.

The oil pressure step bearing at the foot of shaft supports the whole revolving element in a balanced position by perfectly sym-

metrical suspension and preserves the exact relation of level between the stationary and revolving parts. As long as this step bearing fills its functions a multitude of mechanical difficulties and uncertainties are overcome.

At the time this design was adopted there was no good precedent for the support in this manner of such a weight operating at so high a speed, and there were many predictions of failure, examples being quoted where similar methods had failed with water wheels and other machines. It seemed clear, however, that with proper arrangements the operation of this bearing must be stable and reliable, and since forced lubrication was necessary to success in any case, it seemed advisable to put it where it would accomplish the greatest number of good results.

Experience with a number of machines has fully justified our decisions in this connection. The bearings have run perfectly with an inappreciable amount of friction, and when properly supplied with oil operate with perfect steadiness and regularity. In one respect these bearings have agreeably surprised us; that is, they have been much less injured by stoppages of oil than we expected. In the course of our experiments imperfect pumping arrangements have been used and repeated failures of the oil flow have been experienced, but in no case has any damage to the machine resulted. Even the cast-iron blocks which constitute the step bearing are, as a rule, not destroyed. Our experience has been that they cut and heat when the oil supply is removed, but in all cases the surfaces have ground themselves to an operating condition after the oil flow is renewed, so that the machine could be continued in operation. This might not always be the case, but it seems quite certain that the damage could never be as serious as that which would result from a failure of the lubrication system where heavy weights are carried on high-speed horizontal bearings.

In our newer machines we are providing a heavy stationary collar below the lowest wheel which can be used to support the wheels in case the step bearing is removed and which would serve as a brake to bring the machine to rest in case the step bearing should cut enough to allow the wheels to settle to a dangerous degree. Our experience has been that there is very little tendency to settlemnt of the shaft in case of such cutting, and this latter function of the collar will presumably seldom be called into requisition.

The oil for step bearings and also for the upper bearings of machines is delivered by a small electrically-driven pump which operates continuously from the exciter circuit. In most of the large plants where we are installing turbines we have recommended in addition to these electrical pumps, a weighted accumulator with steam pump arranged to keep it full automatically. This accumulator with its steam pump affords an automatic reserve for the lubricating system. Its capacity is such that there would be ample time to shut down the units even if everything in the station should be stopped by the bursting of a boiler or steam pipe.

The 5,000-kw machine in Chicago is the second of our vertical shaft turbines to be put into operation. The first machine of this type was one of 500-kw capacity installed by the Newport & Fall River Street Railway Company. This machine has been in daily operation since last June. During all this time its daily operation has been indispensable to the service of the plant, and there have only been two or three interruptions of a few minutes each which could be charged to its defects. It has, however, developed some minor troubles which have been the cause of some annoyance, and which it has been very difficult to correct owing to the almost continuous operation of the machine. With new types of machinery which have to be put in service without any period of experimenting some such difficulties and delays can hardly be avoided.

The only serious troubles at Newport have been with parts of governor and with valves which have given out owing to overstraining of springs or other mechanical causes which are easily corrected. These troubles have occurred as the result of continued service, and are being rectified as rapidly as it has been possible to analyze their causes and apply suitable remedies. Nothing has happened which suggests the possibility of a serious difficulty, and it can be safely predicted that a condition will very soon be reached in which the turbine can operate for an indefinite period with a very small expense for care and renewals.

Our machine at Newport has been tested and has shown results decidedly better than the reported tests of steam turbines of other makes; but the conditions have been such that we have reasons to believe that decidedly better results can be produced with slight changes in nozzles and adjustments of pressure. Up to the present time we have not been able to experiment with this machine or properly analyze its performance owing to the almost constant requirements of service. We are, however, installing a second machine at Newport, and very soon expect to make a proper analysis of its performances and to bring both machines to a representative condition. All the experience which we can gain with these early experiments is, of course, available for the prevention of similar troubles and mistakes in other plants.

One important matter in connection with the introduction of our turbines has been the establishment of proper condensing facilities in order that the great benefits of high vacuum might be realized to the greatest possible extent. In turbines which we have tested the steam consumption has been reduced from six to seven per cent. for every additional inch of vacuum above 25 in. Such a reduction is, of course, very important, and justifies large expenditures upon condensing apparatus. The fact that the turbine may be better than a condensing engine with equal vacuum must not be considered a reason for assuming that a condenser which is good enough for the engine is also good enough for the turbine. The selection of condensing facilities should be governed by the economic possibilities.

We have recently designed for some of our large new turbines surface condensers which themselves constitute the base and supporting structure of the machine. These condensers are of very ample cooling surface and are so arranged that the maximum degree of vacuum is obtainable with a given amount of water. One feature of our turbine which is very advantageous in obtaining a high vacuum is that it can be easily so arranged that the air leakage is reduced to zero. The two points where the shaft passes through the casing are fitted with packings which are kept sealed by steam. Another advantage is that there is no oil in the steam and consequently that the exterior of condenser tubes is kept perfectly clean. Several turbines with condenser bases are now being built, and it is probable that there will be a large production of machines of this type.

I have mentioned above that no oil comes in contact with the steam in these turbines and I need hardly call attention to the great importance of this fact. The condensed water can be delivered directly back to the boilers and all possibility of trouble in boilers from oil, dirt or scale is eliminated. Even in plants where feed water is good and cheap, this constitutes a great advantage since a considerable amount of heat is saved by using the condensed steam on account of its higher temperature. There is, however, no such a thing as perfectly pure and clean natural water, and there are few boilers that in their average working condition are perfectly clean. Cleanliness in boilers improves circulation and evaporation, prolongs life and constitutes, therefore, a very distinct and definite advantage.

The designs of these first machines started at Chicago and Newport are now about two years old. They were entered into upon the basis of a very limited experience with the turbine, and nothing to guide us other than the theoretical possibilities which previous tests had demonstrated. The period which has elapsed since the conception of these designs has been occupied in a battle with the innumerable difficulties attendant upon the production on a very large scale of radically new devices. When we became convinced of the practicability and the advantages of our designs, we determined that the possibilties could only be developed quickly through production on a large scale and by a concentration of force upon the work. We consequently decided upon guarantees which we felt certain of fulfilment and upon prices which would be attractive to our customers, and have taken a large number of orders for machines of several sizes. We now have on our books contracts aggregating more than 200,000 kilowatts in steam turbine generating units. A large proportion of these machines are now either finished or well under way.

This immense production has been introduced at a time when our regular manufacturing facilities were strained to the utmost and when the difficulty of obtaining or sparing good men was very great. The trials and difficulties of such an undertaking are hard to describe. A vast amount of very expensive special machinery has had to be designed and built and almost every step has required thought and experimenting. In such new work the average man cannot be made to advance with the same confidence that he does on established lines. He presupposes the possibility of difficulty or failure and is constantly being brought to a halt and making mistakes that he would not make under different circumstances. Important processes are handled carelessly and unimportant ones are unduly deliberated over. The strain

is incessant and an abundance of faith is required in those who would direct such work.

As the work of developing these designs has advanced, experience has shown the possibility of better and simpler methods and the steady continuance of experiments has extended our knowledge of the theoretical possibilities. Consequently, new designs have been proposed and developed and we now have in production a large number of machines which we consider greatly superior to those which are now being put into service. This process of experimental development will continue, and the production and test of each new machine will extend our knowledge and make possible further advances.

Our machines at Newport and Chicago and other machines of about the same date are of what we call the "two-stage" type. The Newport machine has two compartments with three rows of moving buckets in each compartment, and the Chicago machine has two compartments with four rows of moving buckets in each compartment. Our later large condensing machines have four stages or compartments with two rows of moving buckets in each. All the details of their design have been worked out in such a manner that their construction is greatly simplified, and the steam economy will presumably be much increased.

Thus, such successes as we may accomplish in the future will be the result of the large experience which responsibility for our existing work has entailed. We have been through long trials and have combated many predictions of failure, but the facts seem to indicate that we have succeeded and to promise that we will in future accomplish greater successes.

DISCUSSION.

Mr. Emmet's paper lead to a lengthy discussion, in which part was taken by Vice-President Ely and Messrs. John I. Beggs, C. O. Mailloux, E. G. Connette, J. G. White and the author. Mr. Beggs said he is very hopeful that the prediction of the General Electric Company that steam turbines will come into general use will be fulfilled. On the other hand, some of the best engineers in the country have expressed to him their doubts on the subject. At present there is nothing to do except to await the curves and tests which Mr. Emmet says are going to be made. He asked if there is not a new power looming up which may as far surpass the steam turbine as that machine surpasses the reciprocating engine, so far as economy goes—namely, the gas engine. If the predictions made for the gas engine, using either illuminating gas, producer gas or gas now produced as a by-product, are to be relied upon, it appears that the present cost of the kilowatt-hour may be cut in two and possibly reduced two-thirds, no matter how high the economy of the present steam plant. He said that a large engine building concern in this country has recently acquired the right to build here the Nüremburg gas engine, and that a 3,000-hp engine of this type will be installed at the St. Louis Exposition direct-connected to a 2,000-kw generator. In the northwest screenings now cost $3.50 a ton, which four years ago cost only $1.70, so that the importance of bringing down the cost of producing steam is of the greatest moment. Mr. Beggs said that at present a steam turbine unit such as Mr. Emmet describes, including the generator, can be purchased for about the cost of the corresponding reciprocating engine, and he remarked that he does not think he is divulging a secret when he states that the Westinghouse unit employing the Parsons steam turbine can also be bought at the cost of the reciprocating engine of equal capacity. Owing to the slower speed of the reciprocating engine, the cost of the accompanying generator becomes one-half that of the engine itself, and that this amount is saved in the turbine is important. An element that comes up in the question of the use of gas engines is the greatly-increased cost of the engine itself, and it is a question of commercial calculation whether this will be compensated for in reduced cost of producing power.

Mr. Ely referred to the fact that in the new plant of the Lackawanna Steel Company, at Buffalo, N. Y., the gases from the stacks of the blast furnaces and the ovens are washed and used as fuel, enough fuel being thus supplied for an installation of 40,000 hp of gas engines. Most of the units are of 2,000 hp. The engineer in charge is a Russian, and Mr. Ely added that in the matter of gas engines, their manufacture and use, we are far behind Europe. Mr. Beggs mentioned a case in the west where a large manufacturing establishment is building 80 ovens for the production of coke, and it is probable that the waste gases will be utilized in generating power. Mr. E. G. Connette suggested that since the gas engine question is a very interesting one it should be made a topic for discussion at the next meeting of the association. Mr. Connette pointed out that ten years ago at the Milwaukee meeting of the association he predicted in a paper that the steam turbine would finally supplant the reciprocating engine.

Mr. Mailloux said that if gas is obtained at a cost which is below 20 cents per cubic foot, the gas engine will be at least as economical as the steam turbine, especially where coal is relatively high; but when a producer is required to make gas the situation is quite different. He referred to a case of a plant of 15,000 kw for which he received estimates for a gas engine plant and also for a steam turbine plant. In the gas engine system the largest unit was about 2,000 hp, and consequently it would be necessary to have something like ten units; this would involve a larger building and a larger maintenance account owing to the greater number of units, and since the gas engine is not a simple device its cost of maintenance would not be small. He also found that to get the economy promised he would have to go into the chemical business; in other words, handle certain chemical by-products; he was told that by the installation of a 3,000-kw plant there would be something like $50,000 a year recovered in the form of chemical by-products. The principal objection was that an initial outlay of over $1,000,000 was required, and in that particular case instead of coming out $100,000 ahead, as against the steam turbine, he would be nearly that much behind yearly.

Mr. Mailloux cited another case of a pumping plant in Mexico, where coal is $15 a ton delivered on a mountain 700 miles from the nearest coal mine. He found in that case that a gas engine operated with producer gas was better than a steam turbine and would pay for itself in something like three or four years. He investigated a case in Arizona where power was to be used in lighting and traction, and he found that the cost was more nearly even, the company being one producing gas as well as electricity. After a careful investigation the steam turbine was adopted. A further investigation has shown that in the present state of manufacture the cost per kilowatt of the gas engine outfit is at least twice that of the steam turbine outfit. He has had a station operating at Newport, R. I., under his direction which has been installed for a year, which has been running one steam turbine unit for a year, and for the last five or six months running two units of 400 kw each. The results have been so satisfactory that recently an order has been placed for two turbine units of 3,000 kw each. The cost of the latter is under $28 per kw, not including the piping or condenser. Mr. Mailloux considers one of the great points in the steam turbine is that it enables the station equipment to be greatly simplified, not only in detail but also in those things which eventually tell in maintenance. There are fewer parts and no adjusting parts. A feature of the steam turbine of the greatest utility is its ability to use high superheat, there being no practical limit to the amount of superheat that may be used. A turbine using steam at a pressure of 150 pounds and superheat up to 600°, gives as good economy as the ordinary engine with perhaps 175 or 180 pounds pressure, using fuel economizers. The cost of the station is less, the expense of running much less and the cost of producing power much reduced. Mr. Mailloux said that the only drawback thus far brought to his attention in connection with the steam turbine is the fact that it is not economical without condensation, and in fact requires a very good vacuum. He has had some difficulty in obtaining a satisfactory vacuum, but has no doubt that after some slight changes which he contemplates the difficulty will be overcome. He feels sure that the condensing outfit for the turbine requires much more care and greater first cost, perhaps $3 or $4 per horse-power.

Mr. J. G. White said that he agrees in the necessity of a high vacuum and high steam pressure with the steam turbine, and also on the advantage of reduced space and saving in initial investment and in oil and other supplies. However, what is needed to be known is how the steam turbine can be depended upon as to reliability. Can we install steam turbines to-day and be certain that they will start off without serious interruption, or at least that after a few weeks of operation they can be depended upon to take up the regular load and carry it day after day? He said he understood that in Newport there are two turbines in operation, and that the original one, which gave considerable trouble, is now said to be down to regular working basis, and that the second unit is in operation and running satisfactorily. He wished to ask how many stoppages there had been during the past sixty days or during some definite period in this plant.

In reply Mr. Emmet said that they had had experience with a 600-kw turbine in Schenectady of the earlier type, and a vertical shaft

turbine at Newport, which is the newest type. The Schenectady machine has been in service two years and has been running almost continuously without any trouble of any kind. The machine located at Newport has carried its load continuously, and of the troubles experienced practically none interrupted the service. A record has also been kept of all stoppages, and service was only interrupted three times between June and September, the longest stoppage being less than twenty minutes. These were caused by a certain amount of trouble in the valves, which had to be corrected from time to time. If the Newport machine as it stands now in its present condition were improved and simply maintained by the renewal of the valve parts as they give out, it could be kept up and run at a small fraction of what it would cost to maintain a reciprocating engine of equal capacity. As to comparing gas engines and steam turbines, Mr. Emmet agreed with Mr. Mailloux that it is purely a question of cost of fuel as relates to the turbine in its present state of development. The calculated fuel economy of the gas engine in its best state of perfection is greater than that of any steam engine heretofore produced; but the very highest results obtained so far with the steam engine in the matter of fuel economy are not far below the results obtained from gas engines. The very best result from the gas engine show a thermal efficiency of 32 per cent., while the best result produced with highly superheated steam under favorable conditions in the steam turbine is something like 23 or 24 per cent. But gas engines operated on a commercial basis runs nearly to 26 or 27 per cent., which figures are not much in advance of the best steam turbine performances. Furthermore, as pointed out by Mr. Mailloux, the gas engine costs probably twice as much as the steam turbine unit, and if the latter is credited with the simplifications surrounding it, the difference is much greater. The steam turbine needs no heavy foundation and the ideal turbine plant will be far removed from the city, laid out on the lines of a coal yard, and an expensive building will not be required. On this basis the difference in cost will be greater than Mr. Mailloux has stated, and even if we capitalize the difference in fuel consumption between the two engines, the amount will not cover the difference in first cost.

Mr. Emmet said the steam turbine as it will be six months hence can be operated by a child indefinitely, virtually without maintenance. The wear and deterioration is nothing and the whole plant can be reduced to an ideal condition of simplification. On the other hand, a producer gas engine plant involves an immense maintenance cost and the maintenance of the engines will be twice that of steam engines, being twice as complicated and less capable of perfect lubrication. If coal continues to increase in cost and gas engines are improved at the same rate that the turbine has been improved, the time will come when fuel economy will be the only consideration, and gas engines will come into more extensive use. Mr. Emmet thinks, however, that the introduction of the steam turbine is certain to give the gas engine a long setback.

Mr. Beggs said that only eleven months ago the quoted cost of the steam turbine unit is double what it really is to-day. This reduction has obviously been brought about by competition between the builders who have acquired the right to construct steam turbines in this country. As to the gas engine in this country, we are in the same position that we were in three years ago with respect to the steam turbine—we scarcely know anything about it. As to the size of units, even the builders of the steam turbine to-day question whether it is not more economical and more advisable to install units of 2,000-kw capacity than units of 5,000 kw.

Referring to the Newport plant, Mr. Mailloux said that the first 400-kw unit was ready early last winter, and owing to a burn-out in one of the old units carrying the load, the turbine was pressed into service even though the packing had not been finished. It has not been stopped except during periods of light load, and then in order to complete the piping and adjustment of the unit. Little difficulty has been experienced in paralleling the two units; there was at first a slight hunting or some disturbance due to imperfect belting, which has been remedied. At first the attendants kept close watch of the unit, but they have become so accustomed to the machine that it is left to take care of itself.

Telephones in Churches.

The churches in New York City have, perhaps naturally, been rather conservative in taking up telephone service, but many have had it established during the past year. Every theatre in town now has telephone service, and many of them have established private branch exchanges.

Saratoga Convention of the American Street Railway Association.

Last week we devoted several pages to the Saratoga convention of the American Street Railway Association, then in full session, and we are now able to close our very full report of what was done by that body and its allied organizations. In every way the convention was a most successful affair, being favored moreover by magnificent weather. It was noted last week that September is not exactly the best season of the year for a street railway meeting, for it catches the roads busy with county fairs, fall festivals, labor-day exercises, harvest festivities and a number of end-of-the-summer holidays which throw heavy traffic on the lines; whereas the usual meeting time, around October, finds all that strain over. Hence, for many it has been quite difficult, if not impossible, to get away to Saratoga at this juncture. On the other hand, when it was decided for various reasons not to go to any city, a resort like Saratoga had to be chosen, and, of course, it had to be visited before the hotels closed, as well as after the usual summer rush had passed away, leaving the needed accommodations available. This meant the beginning of September, with the racing season over and the usual flower carnival a thing of the past. But Saratoga has admirable attractions of its own, inducing attendance, while there can be no question that the formation of the two auxiliary bodies has tended to build up and increase yearly the number of those in attendance.

Saratoga has always been identified with animal power rather than mechanical, and the fame of her horses and her race track has more than equaled that of her medicinal waters. As was shown recently in these columns, the region around Albany, Schenectady and Saratoga is rapidly becoming a centre of long distance, interurban electric railway work; but at the Springs itself there is usually little in sight to remind one of the trolley. Hence the fine display made by the energetic supply men in the grounds of the Grand Union Hotel last week was the more creditable because it had no local *raison d'etre,* no local system furnishing in itself a very complete exhibit of materials. Where everything has a horsey flavor and suggestion ordinarily, an electrical touch was given to the atmosphere, changing the entire environment. As everybody knows, the Grand Union has a vast central court of green lawns and shady paths, environed by the lofty verandas and shut in by the "cottages." It is also beautifully laid out and picturesquely sheltered by lofty trees, through which the sun glanced down brightly by day, while at night the booths were radiant with electrical illumination, so at no time was the effect of the vari-colored bunting, flags, plants, etc., other than grateful to the eye. ELECTRICAL WORLD AND ENGINEER, like some others, occupied a booth under the high-pitched veranda of the hotel, so that should the weather prove unpropitious there would be protection from the rain. This fear did not disturb some of the exhibitors who, trusting to luck, left their handsomely decorated space full open to the sky. A great deal of time and expense was bestowed, as usual, on the exhibits, some of the booths needing little to make them comfortable quarters, while brass railing and handsome furniture appeared everywhere in luxurious profusion. One railing that attracted great and deserved attention was that around the Pittsburgh Reduction space, and was built up entirely of huge tubes of aluminum for rail and posts.

Abstracts appeared last week of papers read at Saratoga before the American Railway, Mechanical and Electrical Association together with the following discussions. At the sessions of the American Street Railway Association proper, on Wednesday and Thursday, seven papers were read. Of these we print elsewhere in full the paper by Mr. H. H. Vreeland, on "Right of Way," and that of Mr. W. L. R. Emmet, on "Steam Turbines."

Mr. Chas. A. Coons presented a paper on "Train Orders and Train Signals for Interurban Roads." He stated that a code of rules for interurban roads should follow very closely the rules in vogue on the best-managed steam roads. After considering the two forms of blanks used by steam roads for the handling of train orders, he suggested certain modifications for use on interurban roads. The modified blanks are, he said, being used with excellent results by the International Railway Company on its interurban lines. As to the relative merits of the telegraph and telephone for transmitting messages from the dispatcher to the operators along the line, the International Company considers there is little to choose between the two systems, and that either one will prove adequate if properly in-

stalled and properly maintained. The first cost is about the same and either system is liable to disarrangement if not properly watched. Further information is given concerning the details of train dispatching according to the system used on the International Road.

Mr. Michael Brennan, of Detroit, read a paper in which he discussed from the legal standpoint the practice of a certain class of lawyers making a specialty of cases of personal injury and whose fees are contingent upon ultimate success. He shows how the prosecution of personal injury cases has become a systematized business, which has led to considerable abuses. In referring to the expert witness, he said that under the present lack of judicial restraint which exists in the United States, he has become a stench in the nostrils of the judges of the land. He quoted the late Judge Baxter, Judge of the United States Circuit Court for the Sixth District, who said that "Liars are divided into three great subdivisions—first, the ordinary liar; second, the damned liar; and third, the expert witness." He pointed out that while in foreign countries there are proper regulations with respect to expert witnesses, in this country as yet little progress had been made to meet the evil. There are, however, at present several movements which it is hoped will lead toward the improvement of the situation. In conclusion Mr. Brennan said that a radical remedy should be applied to correct the abuses now incident to personal injury cases, and he suggests the re-enactment of the old common law prohibiting bargains for the division of damages and inofficious intermeddling in a suit by outsiders.

In the discussion of Mr. Brennan's paper, Vice-President Ely said that while it would be impossible to harmonize the statutes, rules and practices of courts that affect the matter in question, by reason of the association extending through all of the different States, still its recommendations are along the line of standardization, and they may be useful in bringing about or assisting in bringing about, some harmony in the laws.

Mr. J. B. McClary contributed a paper on "Freight and Express on Electric Railways," the result of 182 replies received to a circular sent out asking for data on freight and express handling by electric railways. He considered that there is no more vital subject before the street railways of the country than that of freight and express on electric railways. His investigations showed that of 182 roads which reported 71 handled freight and express; 45 admit that it is profitable, and they intend to increase their facilities for handling this business; 37 say that it is a very attractive feature of electric railroading, and 9 answer that while they carry freight they do not think well of it. The paper then proceeds to examine the replies more in detail, including the several methods of handling freight and express, and gives reproductions of way bills, tariff sheets and other forms. In conclusion, Mr. McClary said that new facilities have been brought into service from time to time to take care of the business; that the freight and express business pays now in a great many instances; that it can be made to pay in a great many more where it is not now paying, and that many roads not giving it any attention at present will soon adopt it.

In the discussion of Mr. McClary's paper Mr. Gotschall said that the subject treated is one of the most important as affecting coming electric railways' connecting centers of population adjoining and about large cities. He has found that electric railways are receiving from express and freight business all the way from $500 to $900 a mile of single track. Mr. Mailloux suggested that owing to the importance of the subject it be made the topic of a discussion at the next meeting of the association. Mr. Beggs agreed that the question of freight and express is likely to become much more important with electric railways as time passes. In many of the States of the Union electric railways are not permitted to carry freight, and in Wisconsin parcels cannot be carried unless in charge of a passenger, and a company has no right to make any extra charge for them. He hopes that the time may come when the demand shall be made in all the cities of the country that electric railways be permitted to perform this great service to the community. Mr. G. Tracy Rogers, of Binghamton, N. Y., gave his experience with electric railway express business. In one instance the city officials objected to a freight car being left on the street, but the merchants came forward and protested since the service was a great accommodation to them and all the people on the line. The plan pursued is to farm the business out to an expressman on a percentage basis, and the business has been fairly profitable. A car makes two trips daily, the distance being about nine miles. Mr. C. Loomis Allen, of Utica, N. Y., said that in December last his company organized an express department on the Utica & Mohawk Valley Railroad. Three cars are operated about 12 hours a day, and in each village or municipality along the line there are teams for the delivery of express matter, and in each of the cities there are teams for collecting express matter. The expense has been in the neighborhood of about 70 per cent of the gross receipts. Mr. W. K. Morley, of Grand Rapids, Mich., said that his company has 45 miles of track on which are run three freight cars, each making a round trip daily. The company proposes to extend the equipment next year, as they find that the freight business pays. The same rates are charged as those of steam roads. Vice-President Ely said that the International Railway Company, of Buffalo, which operates several interurban lines, one of them being a 39-mile high-speed road, handles freight trains drawn by electric locomotives, and carries mail, express, freight, small crops and all kinds of package freight. He drew a distinction between the short hauls of the electric railways, and the profitable long hauls of the steam roads, and he said that if electric railways are to handle freight to any extent an arrangement must be made with steam railroads for cars. The expense of handling freight on electric railways under present methods is very considerable.

Mr. William Pestell read a paper entitled "Electric Welded Joints," which includes a considerable number of illustrations, and opens with a history of the subject from 1893, when tracks were thus welded in a number of cities, up to the present. A table shows that electrically welded tracks have been laid in nine cities, the total number of miles welded being 228. The paper contains a number of illustrations showing methods of welding, and gives in detail the method used in electrically welding twenty-two miles of track in Worcester, Mass. The conclusions of Mr. Pestell are that from the experience in the various cities where new track has been welded it would appear that where permanent grades have been established and the liability of changes in track location are apparently remote, the electric welding of tracks seems advisable. The expense of original construction should certainly be much less than it would be several years later when the joints commence to go down, and it is a question whether it would not be cheaper to weld a good splice bar joint bonded to the same capacity. A test on the electrically-welded joints showed conductivities ranging from 110 to 140 per cent., as compared with equal lengths of solid rail.

Mr. Richard McCulloch, of Chicago, presented an elaborate paper entitled, "Production and Distribution of Alternating Current for Large City Systems." In opening his paper, Mr. McCulloch said that several solutions suggest themselves in the question of power plants as follows: 1. To keep the best of the present plants and add to them as necessary, and adjust the distribution systems from them. 2. To abandon the present plants, construct an entirely new plant with a new distribution from it, using the old plants as substations if they are suitably located. 3. A combination of these two systems, consisting in the beginning of a new plant, the plans of which contemplate the operation of the entire system from it at some future date; putting at the present time enough apparatus in the station to take care of the growth of the system and adding to it from year to year as the other stations are abandoned.

The paper takes up in detail the case of the production of alternating current by steam power at a central power station, its transmission at high voltage to substations and its conversion there into 575 volts direct current for distribution by means of feeders to the trolley sections. The subject is treated under the heads of size of station; coal supply; building; coal and ash-handling machinery; mechanical stokers; boilers; engines; steam turbines; superheated steam; condensers; steam pressure; piping; auxiliaries; division into units; frequency; phase; operation of generators; switches; central station plans; transmission voltage; transmission cables; conduit; substations; rotary converters; storage batteries for substations; low-tension switchboard; substation plans; the relative advantages of alternating and direct-current generation and transmission. Among some of the more salient points brought out under these various heads are the following:

The use of mechanical stokers is recommended, and for the installation of boilers a two-story boiler room is usually required. With a special valve arrangement the steam may be used in ordinary engines superheated 150 degrees F. Some manufacturers of water-tube boilers now make an attachment to be placed in the path of the heated gases within the brickwork of the boiler by means of which 200 degrees of superheating may be obtained. It is recommended that the auxiliary apparatus, such as used with the coal and ash convey-

ing machinery, mechanical stokers, feed and condenser pumps, cranes, exciters, elevators, etc., should so far as possible be driven by motors, preferably induction motors. In the case of one large alternating-current plant now being constructed, small alternating-current generators driven by turbines are being installed to furnish currents for driving all the induction motors in the plant. Rotary converters driven by this current furnish direct-current at 250 volts for exciting the main generators and for lighting the plant. A storage battery will be installed on this circuit to steady fluctuations and furnish a reserve in case of breakdown.

It is advisable to divide the plant into a number of entirely independent units. An emergency steam connection should be made between the steam headers, but for emergency use only. In any case it is best practice to carry the high-tension cables underground in conduits. Paper insulation for cables is preferred by many to rubber. The cross sections of the copper may be taken very conservatively at 1,000 circular mils per ampere for rubber insulated cables, and 900 mils per ampere for paper insulated cables. The copper cross section should be taken by estimating the drop in voltage at maximum load, but for the comparatively short distances of city work it will usually be found that the drop in voltage is very small in a cable properly proportioned for the current it has to carry. Owing to the rapid increase in the cost of cables when the voltage is above 10,000 volts for rubber and above 15,000 volts for paper insulated cables, these appear to be the limiting voltages for railway underground distribution. In city practice the substations should be designed and built with as much care as used in power plant construction, should contain sufficient reserve apparatus to prevent any ordinary breakdown, and should be constantly in charge of skilled attendants. There seems to be no reason why rotary converters should not be built in sizes as large as direct-current generators, which have been extensively built in sizes up to 2,500 kilowatts. For city service rotaries may have simple shunt fields instead of being compound wound.

The subject of storage batteries was discussed to some length. Figured at the one-hour discharge rate, the relative first cost of storage battery as compared with rotary converter for a steam plant, is approximately $90 per kilowatt first cost, and $130 per kilowatt for the rotary equipment, the latter figure consisting of $30 for the rotary plant and $100 for the corresponding steam plant and transmission line. A battery worked on a peak at its one-hour rate is apt to cost the same or somewhat less than the apparatus which it displaces. No general statement can be made in regard to the advisability of storage batteries, as the question should be figured out for each special case. The reserve function of the storage battery is especially valuable because it may be put into service immediately, having in this an advantage over a reserve steam plant.

The paper concludes with a discussion of the relative advantages of alternating and direct-current generation and transmission. The conclusion is that it is difficult to make any recommendation as to the choice of alternating or direct-current distribution for this depends so much upon local conditions. In some of the largest cities where heavy loads must be taken care of at long distances from the power station, or where the power station cannot be located near the centre of the load, or where reasons exist such as cheap coal, water transportation, etc., located some distance away from the centre of the load, alternating-current distribution from the power station will probably be found more economical; but if a location can be obtained near the centre of the load at a reasonable price and the city load is comprised within a radius of five miles from this point, as is the case in most cities of less than 250,000 inhabitants, it is probable that direct-current generation and distribution from a central station will be the more desirable.

Following are the officers-elect of the American Street Railway Association and affiliated bodies:

AMERICAN STREET RAILWAY ASSOCIATION.

President, W. Caryl Ely; first vice-president, Edwin C. Foster; second vice-president, John Grant; third vice-president, James F. Shaw; secretary and treasurer, T. C. Penington. Members of the Executive Committee: J. C. Hutchins, A. B. Colvin, G. Tracy Rogers, W. A. Smith and S. L. Nelson.

AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION.

President, E. W. Olds; first vice-president, Alfred Green; second vice-president, C. F. Baker; third vice-president, W. O. Mundy. Members of the Executive Committee: T. J. Mullen, H. H. Adams, D. F. Carver, H. J. Lake. Secretary and treasurer, Walter Mower.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA.

President, F. E. Smith; first vice-president, F. R. Henry; second vice-president, C. O. Simpson; third vice-president, J. J. Magilton; secretary-treasurer, W. B. Brockway. Executive Committee: H. J. Davies, O. C. Rogers, S. G. Boyle and H. M. Pease.

W. CARYL ELY.

WILLIAM CARYL ELY.

Mr. William Caryl Ely, the newly-elected president of the American Street Railway Association, is well known to the electrical fraternity through his connection with various electrical enterprises in Buffalo and Niagara Falls. He was born in Middlefield, Otsego County, N. Y., in 1856, his family being of New England origin. He studied law, and in 1882 was admitted to the bar at Ithaca, N. Y. He removed to Niagara Falls in 1885, where he continued the practice of law until 1899, when he retired in order to accept the presidency of the Buffalo Railway and allied companies, Mr. Ely was one of the original promoters and incorporators of the Niagara Falls Power Company, and was also the principal promoter of the Buffalo & Niagara Falls Electric Railway, of which he was the first president. He was also president of the Buffalo & Lockport and Lockport & Olcott Railways, in the construction of both of which he was actively engaged. In 1898 he successfully accomplished the consolidation into one system of all the electric railway systems in Buffalo, Niagara Falls, Tonawanda, Lockport and vicinity, together with other railways and allied interests around Niagara Falls in Canada. All of the operating companies with one exception have been consolidated into the International Railway Company, the entire capital stock of which is owned and held by the International Traction Company, Mr. Ely being president of both companies. The International Traction Company owns and operates 352 miles of electric railways, also two of the large bridges crossing the Niagara River.

Mr. Ely's active connection with the Pan-American Exposition and his interest in the undertaking was one of the elements that brought it to a successful issue. As a member of the Executive Committee of the Exposition he wielded a large influence in its affairs. Mr. Ely is a director in various banking and manufacturing concerns in Buffalo and Niagara Falls, and under his presidency no doubt the American Street Railway Association will, during the next year, continue to prosper and exert an everwidening influence in the national development of the electric railway.

E. W. OLDS.

EDWIN W. OLDS.

Mr. Edwin W. Olds, who has been elected president of the American Railway Mechanical & Electrical Association, is a man of force and of well-recognized ability. He was born in Vermont, where his father was proprietor of a general machine shop; and even during his years of school he was thus able to indulge his pronounced taste for mechanics. In fact, he was early placed in charge of work of the kind to which his whole life has since been devoted. For nearly fifteen years past Mr. Olds has been connected with street railway work, the introduction of electricity giving him an opportunity he was not slow to seize. In 1890 he became associated with the Denver Tramway Company, and in 1896 he joined the staff of the Milwaukee Electric Railway & Light Company, with which he is still connected in the capacity of superintendent of rolling stock. Mr. Olds is a man of very quiet and dignified bearing, a clear thinker, an admirable executive and one who enjoys the esteem and confidence of his associates. He took a prominent part in forming the new association last year, and has contributed actively to its proceedings.

MR. F. E. SMITH.

F. E. SMITH.

The new president of the Street Railways Accountants' Association of America, Mr. F. E. Smith, has been prominent for some years past in accounting work in the street railway field. Some years ago he was auditor of the Zanesville & Ohio Railroad Company, and later was auditor for five years of the Lynn & Boston system, one of the busiest in the country. When a large number of railways in New England were drawn together into the great combination and consolidation known as the Massachusetts Electric Company, Mr Smith was appointed general auditor for that corporation. About four years ago he went to Chicago, where at the present time he is auditor for the Chicago Consolidated Traction Company, as well as auditor for the receivers of the Chicago Union Traction Company, both being positions of great difficulty and responsibility.

Mr. Smith has always taken a very active part in the work of the Accountants' Association, and under his administration it is destined to be increasingly useful in perfecting the methods of account keeping in vogue amongst street railways.

Test of Wine by Telephone.

It is stated that M. Maneuvrier, assistant director of the Laboratory of Researches of the Paris Faculty of Sciences, has just discovered an infallible method of ascertaining by the use of the telephone how much a given quantity of wine has been watered. The principle on which the invention rests is the variable conductivity of different liquids. The originality of Mr. Maneuvrier's ingenious application is his use of the telephone to determine to what degree the liquid under observation is a conductor.

The apparatus works as follows: Two vessels, one containing wine known to be pure, the other the same quantity of the wine to be tested, are placed on an instrument outwardly resembling a pair of scales. The telephone is in contact with both liquids. If the sample of wine under observation is as pure as the standard used for comparison, no sound is heard; if, on the contrary, it contains water, the telltale telephone "speaks," and the greater the proportion of water the louder the instrument complains. A dial on which a number of figures are marked is connected with the telephone. To ascertain the proportion of water in the wine tested the operator moves a hand on the dial until the telephone, which has been "speaking" all this time, relapses into silence. The hand has thus been brought to a certain figure on the dial. This number is then looked up in a chart, which the inventor has drawn up, and corresponding to it is found indicated the exact proportion of water contained in the quantity of wine.

M. Maneuvrier's remarkable invention can, he says, be easily applied to the testing of many other liquids and even solids, which may be adulterated by the addition of foreign matter possessing a conductibility different to that of the original substance.

Electrical Engineering in the Navy.

According to the *New York Herald*, Secretary Moody is considering the abolishment of the Navy Bureau of Equipment, and the distribution of its present functions among the remaining bureaus. In this event electrical engineering would come under the cognizance of one of the engineering bureaus of the navy.

Government Telegraphs and Telephones in Great Britain—I.

TELEGRAPHS.

The forty-ninth report of the British Postmaster-General, covering the operations of the Post Office for the year ending March 31, 1903, contains some interesting figures and statements relating to the working of the British telegraphs and telephones. Some of these are so striking that it is a pity to allow them to remain buried in a government report.

TELEGRAPH STATISTICS.

The total number of telegrams sent over the Post Office wires during the year was 92,471,000, an increase of 2.3 per cent. over the number sent in the previous year. Ordinary inland telegrams account for 75,883,000, of a total value of $11,589,170. Curiously enough, while the number of telegrams was 1,161,000 in excess of the number of the previous year, the receipts were over $15,000 less, showing that the British public has been studying economy in the wording of its telegrams. The average value of an inland telegram fell from 14.9 cents to 14.82 cents. The rate is one cent a word, irrespective of distance, with a minimum payment of 12 cents, address and signature being charged for, not free, as in this country.

The following table gives the number and value of each class of telegram for the past two years:

	NUMBER.			RECEIPTS.		
Class of Telegram.	1901-2	1902-3	Increase.	1901-2.	1902-3.	+ or —
Ordinary (inland)	74,721,000	75,883,000	1,161,000	$11,606,385	$11,589,170	—$17,215
Press (inland)	6,216,000	6,453,000	237,000	683,900	718,700	+34,800
Foreign	7,627,000	7,901,000	274,000	1,816,265	1,881,495	+65,230
Railway, free	1,356,000	1,411,000	55,000	.....	.....	.....
Railway, reduced rate	30,000	30,000	.....	2,780	2,780	.....
Government, free	482,000	793,000	311,000	.....	.....	.....
Totals	90,432,000	92,471,000	2,038,000	$14,109,330	$14,192,145	+$82,815

The estimated value of the railway free telegrams, which are sent in payment for wayleave privileges, is $288,080 and of government free telegrams, $233,110, making a total of $521,190.

The British postal telegraphs are, as is well known, operated at an enormous loss, and a large proportion of this loss is due to the extraordinarily cheap rates at which press messages are carried. It will be seen from the table above that the press messages brought in only $718,700, or an average per message for 6,453,000 messages of a trifle over 11 cents. The average weekly number of words in press messages is given in the report as 14,890,712, giving a yearly total of 774,316,024, or an average number of words per press telegram of just over 120. Therefore, press telegrams are sent at the rate of eleven words for a cent, while the general public pays one cent for each word. This results in the Post Office doing for the press an amount of work equivalent to 70 per cent. of what it does for the public at about 6 per cent. of the price. This clearly must entail a very large loss to the Post Office, as one mill per word for telegrams over the length and breadth of Great Britain is a losing figure. If press telegrams were paid for at half rates the 774,316,024 words of press messages would bring in $3,871,580.12 in place of the $718,700 they did bring in during the past year, a difference of over $3,150,000, which would be more than sufficient to wipe out the deficit on the working of the system.

The explanation that has been given of the extremely low rates for press telegrams is as follows: When the government took over the telegraphs in 1870 a rate for press telegrams was established of 25 cents per 100 words, with 4 cents per 100 words or less for each additional copy of the same messages. The rate for additional copies was intended to apply to extra copies of messages delivered to separate addresses in the same town. But the astute business men of the Fourth Estate gave it a wider meaning and claimed that they were entitled to send the same message to any number of towns paying at the rate of 25 cents per 100 words for one transmission and 4 cents per 100 words for every other transmission. The Liberal Government of the day, wishing, it is said, to stand well with the press, conceded the interpretation of the rate desired by the press. So now we have the spectacle of the Postmaster-General refusing to admit magazines to the post at the newspaper rate of postage and at the same time making a present to the newspaper press of at least a million and a half of dollars annually in telegraphic facilities. No doubt the newspapers are well pleased, but it is not business.

The report states that every class of telegram shows an increase over the previous year, the numbers both of inland and of foreign telegrams being the highest ever recorded. The inland telegrams sent in June, 1902, exceeded those for June, 1901, by over half a million, the increase being due to the illness of the King and the postponement of the Coronation. On June 23 no fewer than 201,559 telegrams passed through the Central Telegraph Office in London, on June 24, 311,039, and on June 25, 314,126. The largest number previously recorded was 199,155 on the day before the funeral of Queen Victoria. The large increase in government free messages, 311,000, or over 65 per cent., was also chiefly due to those sent in connection with the illness of the King. The pressure of work at this period, both in London and in many of the provincial offices, was very severe, and taxed to the utmost the energies of the staff.

The total number of telegraph offices in the United Kingdom is 12,129, of which 9,777 are at post offices and 2,352 at railway stations and other "agency" offices. During the year 347 new telegraph offices were opened, as against 259 in 1901-2.

LINE CONSTRUCTION.

The telegraph lines suffered to some extent from storms during the year, notably in February last, but grave as was the interruption caused to the service, it has been a source of satisfaction to find how great an advantage is gained on such emergencies from the underground cable already laid northwards from London. During the year the underground line laid between London and Birmingham about three years ago was extended to Warrington, nearly 200 miles from London, where it joined existing underground lines between Manchester, Liverpool and Chester. In addition to this work pipes to the extent of 54 miles have been laid north of Warrington and during the present financial year it is hoped to complete the line of pipes to Carlisle, 300 miles north of London, and to lay a line from Manchester to Leeds, 45 miles, besides putting down underground work in one or two other places exceptionally exposed to storm damage. Reserve wires for use in emergencies, carried as far as possible by alternative routes, have been provided during the year in many parts of the kingdom.

Regarding the difficulty of carrying out new construction the report speaks as follows: "The construction of telegraphs both underground and overhead is becoming far more difficult than in former years. Not only by the growth of telegraph and telephone systems is the space available for overhead wires along the roads and streets getting filled up, but a new class of difficulties has arisen from the extension of electric light and power services. These services are operated by powerful electric currents, which would be a grave source of danger, alike to post offices and to the lives of my staff, if contact were made with telegraph wires through breakage or otherwise; and it is well that the statutory powers of the Postmaster-General enable me to insist on the provision of various safeguards wherever light or power installations are established near the telegraphs."

A TELEGRAPH MULTIPLE BOARD.

A great improvement in the metropolitan telegraph service has been brought about by an intercommunication switch, on the principle of a telephone multiple switchboard, which has been specially designed and has recently been installed in the Central Telegraph office. By its means the various London telegraph offices, which number between five and six hundred, are enabled to communicate directly with each other, thus saving the retransmission of the telegrams at the central office.

WIRELESS TELEGRAPHY.

The attitude of the Post Office toward wireless telegraphy has hardly been fairly represented, so the references to that subject may well be quoted in full. The report says: "On the subject of wireless telegraphy, I have had much communication during the past year with the other government departments concerned in the matter (the War Office, the Admiralty and the Board of Trade), with Mr. Marconi and with the two companies which possess his rights. It is now nearly eight years since Mr. Marconi first came to England and received at the hands of the officers of the Post Office all the assistance which they could give him; and the subject of wireless telegraphy has been watched ever since by them with the keenest interest.

"I have provided for the Marconi Company a private wire from Poldhu to Falmouth on the usual rental terms, and I have explained to the company the conditions upon which the Post Office can become its agent for the collection of messages to be transmitted across the Atlantic by the wireless system. I have found it necessary to impose certain conditions intended to safeguard other national interests, and I have also pointed out that, before the Post Office can act as agent for the company the company must satisfy me that it is in a position to carry on its business and transmit messages from one side of the Atlantic to the other. It is obvious that until I am satisfied on these points I should not be justified in accepting messages and collecting charges from the public for a service which the company might possibly not be in a position to perform efficiently.

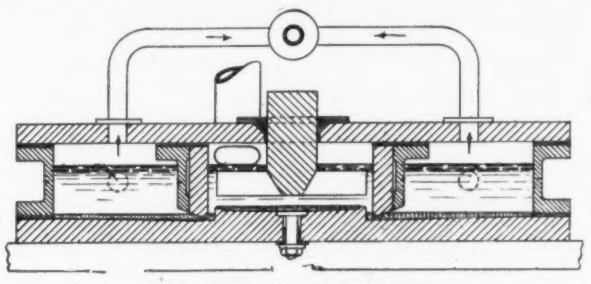
"I have also devoted much attention to the question of the establishment of ship signalling stations on the coasts of the United Kingdom for wireless telegraphy. This question involves the relations between the Admiralty, Lloyds and the Marconi Companies, and it has been possible at present to arrive at a definite position."

Recent Electrochemical Developments.

MERCURY CATHODE CELLS FOR THE ELECTROLYSIS OF BRINE.

Commercial success of the use of a mercury cathode in the electrolysis of sodium chloride for the production of caustic soda and chlorine, has, up to the present, been confined to the Castner-Kellner process which is successfully operated at Niagara Falls. Only two other mercury cathode processes have been tried in this country on a larger scale. The one is the Rhodin process, which was in operation for some time at Sault Ste. Marie, but the plant is now closed, apparently for the reason that the cost of the process is too high in these times of war between the chemical and electrochemical alkali companies in Europe, the market for the product being thereby utterly demoralized. The other process is that of G. & G. W. Bell, which is to be used in a plant of the Pennsylvania Salt Manufacturing Company in Wyandotte, Mich. While experiments have been going on there for quite a while, the process does not yet appear to be developed to a large industrial scale.

The process of G. & G. W. Bell is in general quite similar to the Castner-Kellner process. As shown in cut below, there is an electrolyzing chamber intermediate between two oxidizing chambers. The



BELL MERCURY CATHODE CELL.

electrolyzing chamber contains sodium chloride, the anode being provided at the top of the cell, and a layer of mercury at the bottom forming the cathode. By electrolysis, the mercury of the cathode is changed into sodium amalgam. When the concentration of sodium in the amalgam has become sufficiently high, the amalgam is forced into the oxidizing chambers for the production of caustic soda. The mercury, thus freed of the sodium, is then brought back into the middle department and the same process starts again. The feature which distinguishes this process from the Castner-Kellner process is the automatic method of forcing the amalgam from the electrolyzing chamber to the oxidizing chambers, and forcing the mercury afterwards back into the electrolyzing chamber. This is accomplished by making use of the pressure of the gas developed during electrolysis. The gas exit is alternately opened and closed, with the result that the mercury is moved the one or the other way.

In a patent, granted on September 1, to Messrs. G. & G. W. Bell, some improvements of this cell are described. The pressure is produced in the oxidizing chambers by the hydrogen which is evolved there when the amalgam gives off the sodium to form sodium hydroxide. The subsequent release of this pressure is controlled by a valve in the main hydrogen pipe, the automatic operation of the valve being produced by electromagnetic means.

The principal condition which any process for the production of caustic alkali and chlorine must fulfil, is, of course, the provision of effective means to prevent the recombination of the anodic and cathodic products. Three general means to this end are known in the art: First, the mercury cathode which removes the sodium

cations from the electrolyzing cell; second, the diaphragm processes, in which the anodic and cathodic compartments are mechanically separated by means of a diaphragm; third, the gravity process (Glocken process) in which the anodic and cathodic layers of the electrolyte are kept separate from each other automatically by utilizing their different specific gravities.

A combination of the mercury cathode process with the gravity process is made use of in a cell of Mr. A. Brichaux, of Brussels, for which patent was granted on September 1. The mercury cathode process has the disadvantage that the anodically-developed chlorine gas may saturate the electrolyte and thus come into contact with the amalgam cathode; this would, of course, produce reactions which are not wanted. To prevent this, the author employs a dense layer of saturated sodium chloride directly above the mercury cathode, and upon this layer of greater specific gravity a layer of lower gravity rests; this lighter upper layer contains the anode and may be saturated with chlorine, but the lower heavier sodium chloride layer acts like a diaphragm for the chlorine for the reason that it does not readily absorb the chlorine, so that the latter cannot reach the amalgam cathode.

ELECTROLYTIC PREPARATION OF LITHOGRAPHING PLATES.

A patent was granted on September 1 to Mr. O. C. Strecker, of Darmstadt, Germany, for a process of electrolytically preparing lithographic plates. The principle is to use the plate as one electrode in a suitable electrolyte, and to apply an alternating current by which a layer of oxides is formed on the metal; this layer is afterwards transformed by chemical means into an insoluble layer of salts adhering firmly to the metal. Preferably zinc or aluminum plates are used. A zinc plate is ground by means of a pad of felt and pumice powder, rinsed with water and dried. On this plate is fixed a lithographic design, the negative of the intended print; the plate is then gummed with a solution of gum arabic of medium strength, and when perfectly dry, the greasy substance is washed out by lithophin, which is a solution of asphaltum in benzine. The excess wiped off, the plate is then dried, and finally the gum arabic washed off by water. The lithographic design is then left on the plate as a layer of asphaltum. Aluminum plates may be treated in the same way with a similar result.

The plate is now used as electrode in a solution of 3 per cent. of a neutral phosphate, sulphate or the like. The passing of the alternating current causes the formation on the plate of a layer insoluble in water and probably consisting of oxides or hydroxides of the metals employed. As the character of this layer is either neutral or basic, it is not fit for printing purposes and must undergo another chemical treatment. In many cases a treatment with a weak acid is sufficient to make the plate fit for lithographic printing.

BATTERY INVENTION.

A patent which is of great interest in connection with the new Edison iron-nickel storage battery was granted on September 1 to Mr. E. W. Jungner, of Norrkoeping, Sweden. It has been well known for some time that Edison and Jungner have, independently of each other, been working along the same general lines of battery invention, both developing that general type of accumulator to which Dr. A. E. Kennelly has given the name of "oxygen-lift cell." The original application for his patent was filed by Jungner on April 17, 1899; it was then divided and the application for the present patent filed on June 23, 1902. While the reaction of the Edison iron-nickel cell may be briefly represented by $Fe + NiO_2 = FeO + NiO$, indicating that oxygen is "lifted" from the nickel to the iron, the general type with which Jungner's present patent deals may be represented by the equation $MOH + N = M + NOH$, where M and N are suitable metals. In this case hydroxyl is "lifted" from one plate to the other. An alkali hydrate is used in both cases as electrolyte. As suitable materials for M and N, Jungner mentions iron and manganese, the reaction during discharge proceeding in two steps, represented by the equations $Fe + 2\,Mn\,(OH)_4 = Fe\,(OH)_2 + 2\,Mn\,(OH)_3$ and $Fe\,(OH)_2 + Mn\,(OH)_4 = Fe\,(OH)_3 + Mn\,(OH)_3$. The theory for the "hydroxyl-lift cell" may, of course, be developed in a manner quite analogous to that of the oxygen-lift cell. In both cases the electrolyte remains unchanged. The first claim of Jungner's patent reads as follows: "In a reversible galvanic cell, an alkaline electrolyte and electrodes therein having action masses of metallic oxygen compounds, said active masses insoluble in the electrolyte under all conditions of working."

A patent was recently granted to Mr. G. E. Hatch, of Quincy, Mass., for an improvement of the type of cell in the development of which he has been interested for some time and in which rigid porous supports are used to hold the active material together. He now employs such porous supports only for the active material of the positive pole electrode, while the negative pole electrode is directly in contact with the electrolyte.

A similar construction is applied in a zinc-lead battery in a patent recently granted to J. Middleby, Jr., of Malden, Mass. In order to prevent the formation of zinc trees during the charge of the battery, he surrounds the zinc plate with a pair of porous inert plates; these porous plates are provided on their opposed faces with a series of ribs, and the zinc electrode is in contact with these ribs.

New Telephone Patents.

COMMON BATTERY LINEMAN'S TEST SETS.

For many years, in fact almost from the advent of the telephone exchange down to the general adoption of common battery systems, the lineman's test set consisted of a "test box" containing a magneto generator and carrying a large diameter telephone serving for both transmitter and receiver. By howling at this telephone a lineman can make himself understood at some considerable distance from the central office. With common battery systems the magneto, however, became of little service to the lineman, who, therefore, often carried nothing but a head receiver, of which the transmitter qualities are very poor. This has led inventors to attack the problem of a satisfactory portable transmitter and receiver set. Patents have recently appeared for two such sets built upon entirely different lines. One represents the American Telegraph & Telephone Company, having been developed at the hands of Messrs. Barrett, Falk and Shreeve. The second has been patented by H. G. Chalkley, of New York City.

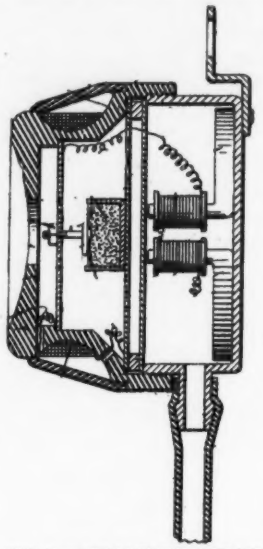


FIG. 1.—CHALKLEY PORTABLE TELEPHONE.

Mr. Chalkley's instrument is of very compact design and is shown in Fig. 1 in section. A two-compartment case carries both receiver and transmitter, the latter superimposed upon the former. About the transmitter case a resistance coil is wound, which is connected in shunt with the carbon button, both these being in series with the receiver portion. When a common battery line is available, the current from this enables the lineman to use his transmitter, the flexible tube from the receiver chamber serving to conduct the received speech to the ear. In case current is not available, the receiver may be actuated as a magneto transmitter through the same mouthpiece as before, the shunt resistance serving to overcome any disturbance at this time due to the carbon button.

Fig. 2 shows a section of the other instrument, which is of the hand microphone type. The handle of hollow sheet metal, shaped to conceal as far as possible all connections or delicate parts, carries a watchcase receiver at one end and a transmitter at the other end. The receiver and transmitter are mounted in approximately similar

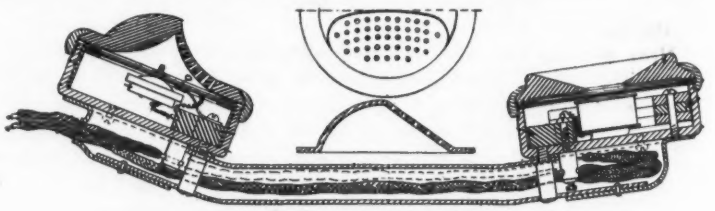


FIG. 2.—PORTABLE TELEPHONE.

planes, so that the transmitter button will always be in a position to give good efficiency. The transmitter is of the "inertia" type, wherein both electrodes are supported by the diaphragm. The transmitter mouthpiece is peculiar, being a perforated curved plate, presumably to protect the diaphragm from injury.

PORTABLE SET FOR USE BY THE DEAF.

Mr. M. R. Hutchison has designed and patented a compact set of instruments to be carried by those partially deaf and used after the usual manner to assist in hearing. A receiver of special type, together with an automatic switch, the equivalent of the usual hook switch, a transmitter with sound concentrating horns and deflecting

vanes and suitable batteries, are all mounted in a portable case, which may be closed to look like an ordinary box, or opened for service, by means of a controlling lever which locks in the desired position the sides constituting the deflecting vanes.

A DEPARTURE IN SELECTIVE SYSTEMS.

While the output of selective signalling patents has been almost continuous, the principles upon which the various systems have been founded have been limited to a very few fundamentals, namely, step-by-step selection, synchronous clockwork devices, polarized impulses and variation of frequency of the signalling current. We have now for consideration, however, a system based upon the Wheatstone bridge or potentiometer principle. This system is not entirely novel with the present patents, as an earlier patent granted to the same inventor, S. A. Reed, of New York City, described its application to a private line. The present patents are, however, the first appearance of its application to exchange lines.

The two patents for this latter application provide two very different systems, the one essentially series in connection and the second bridging, the foundation of the two systems being clearly indicated by the diagrams of Fig. 3. Consider first the left-hand diagram. It is evident that with the battery connected as shown there is the same fall of potential along each side of the loop, and this is equal to the battery voltage. It is also evident that for each point on one side of the loop, there must be one point on the other side of the loop of equal potential; consequently, if these corresponding points be connected, no current will flow on the connecting wire. It is also equally evident that if any two points not properly related be connected, current will flow. Now, in the diagram, the side of the loop, *q, A, B, G'* represents one side of the subscriber's line in question, consisting of the line wire between the stations and of an electromagnet in series at each station. This all being in permanent connection, the line enters each station at a certain fixed and constant potential. The side of the loop, *q, a, b, p,* is an artificial line of resistance wire of any chosen total resistance. Now, as before noted,

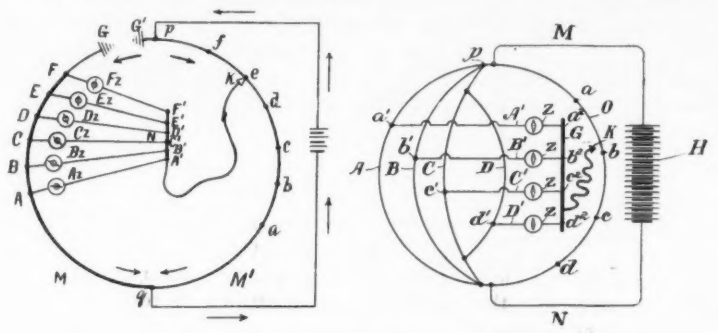


FIG. 3.—REED SELECTIVE TELEPHONE SYSTEM.

a series of points can evidently be established upon this artificial line to correspond to the constant potential at each of the various stations. This would, however, involve a potential wire from each such station to the central office and the system would effect little saving over individual lines. If, however, a common potential lead may be used, then a saving of line is effected, as with only one side of the talking line required for the loop, the second side is available as the potential wire.

Now, it is a fact that a common potential wire may be used, provided that the electrical resistance from station to station when measured upon the potential wire be kept very high compared to the line resistance between the stations. It is easy to make this resistance high, as in order to use the equality of potentials of certain points as a means to selection, an electromagnet must be inserted in the tap to the potential wire, and it is very easy to make the resistance of this magnet and thus the resistance from station to station over the potential wire as high as desired. The combining of potential wires has one effect, namely, the displacing slightly of the equipotential points, but this is of no serious consequence as long as the number of stations to be selected be reasonable.

Fig. 3 shows in diagrammatic form the reduction of the system to practice. Herein at each station in one side of the line appears an electromagnet, *Y*. This is a polarized magnet controlling a switch arm. The switch arm swings between two contacts, from both of which it is normally held clear, but toward either of which it may be thrown at the will of the exchange operator. The forward contact is that completing the circuit of the normally open telephone set. The rearward leads to a device marked *z*, which is constructed like a coarse D'Arsonval galvanometer, the needle of which forms a mechanical stop for the switch arm except just when it is in its mid or undeflected position.

The act of selection is as follows: The operator desiring station *E*, depresses her battery key, *s'*, which causes the switch arms of all magnets, *Y*, to close their back contacts. The operator now presses selective key, *e*, when all needles, *Z*, will deflect except that at station *E*. This is evident from the consideration that point *e* was so chosen so that its potential shall equal that of the switch arm at *E*, and differs from that of every other station. At this stage, with all needles except that at the desired station deflected, the operator throws her snap reversing key, *P*. The sudden reversal of current and the polarized condition of the switch magnets combine to throw violently all switch arms forward. As this action is quick, the deflected needles do not have time to return before the switch arms strike them, and the needle and arm become mutually locked in a mid position. At station *E*, on the other hand, needle *Z* being undeflected, the switch arm takes its full stroke to the first contact anvil. It thus connects the telephone at *E* across the line where it may be rung in the usual manner, the operator using her regular ringing key. Of course, there is no danger of calling any station other than *E*, as at no other station is the bell connected to line.

Reverting to the right-hand diagram of Fig. 3, an explanation of Mr. Reed's bridging system will be readily intelligible. In this system as before we have one side of the loop formed of an artificial resistance line and the other side formed of the subscriber's line and polarized electromagnets. In this latter case, however, this line side of the loop is multiple in character, as the electromagnets being bridged, there is one branch for each station. These branches all have exactly corresponding potential fall along them just as did the two branches of the former system; and just as corresponding equipotential points were existent on the two branches in the former case, so now are they existent upon all branches of the present case. For convenience, however, but one point is chosen on each multiple branch, all these being compared to points upon the right-hand or artificial line side of the loop. The functions and construction of the polarized switching electromagnet and of the deflecting member are exactly similar to those of the former case, the resistances, of course, being adjusted to meet the new bridged conditions, and the switching magnet windings being provided with a potential wire terminal connected at such a point as to correspond to the potential of the proper central office selective key. As in this system both line wires are involved in the potentiometer loop, the earth must be used as the selective circuit.

There are many special features of the apparatus made necessary by the fact that selection is based upon a balance of potentials, which balance is easily disturbed. Thus, when a station calls it is necessary that the selective vane be mechanically locked by the calling subscriber until the operator answers, as otherwise when the operator locks the line she would lock out the calling subscriber with the other stations. Again, special provision must be made to enable one to call a station on his own line, etc. All these locks, keys and mutually acting attachments are a considerable disadvantage from a maintenance standpoint, while the use of a grounded selective circuit in the bridging system is highly questionable for locations with grounded trolley circuits. Nevertheless, the novelty of the system is such as to warrant considerable study.

Municipal Electricians' Convention.

The closing days of the eighth annual convention of the International Association of Municipal Electricians at Atlantic City, N. J., were made interesting in addition to the regular business and reading and discussion of papers by a lecture on "Wireless Telegraphy and Telephony," by A. Frederick Collins, who enlightened his hearers with information concerning an art which is rapidly assuming a practical and commercial form. Another interesting feature of the last night's session was the exhibition of the Cooper Hewitt lamp in operation.

The social features of the convention were much appreciated by the delegates and the ladies attending. The local reception committee and City Electrician A. C. Farrand made every arrangement for their entertainment, which was much enjoyed.

The officers elected for the ensuing year are A. C. Farrand, president; first vice-president, E. G. Petty; second vice-president, G. F. Macdonald, and secretary, Frank P. Foster, the latter having ably

filled that office for many years with satisfaction to the association.

Among those attending the convention and not mentioned in our last issue were Mr. Howard H. Balliett, of the Anderson Porcelain Company, East Liverpool, Ohio, and C. B. Roulet, of the Osburn Flexible Conduit Company, New York.

An Expert Opinion on the New York Subway.

Mr. Maurice Fitzmaurice, chief engineer of the London County Council, has spent a week in this country, all of which he has devoted to the study of the subway and other local transportation systems. Of the New York subway Mr. Fitzmaurice had nothing but praise. He was most struck with the fact that the subway is at such a high level. "When this is finished," said Mr. Fitzmaurice, "I think you will have the finest subway that has ever been built. It is not to be compared at all with the London undergrounds, for they are all about 60 feet below the surface. You have to go down to them by hydraulic lifts—elevators. Of course it is much more convenient to go down only a few steps, as the people will do here. You cannot build things without a little inconvenience. When this subway is completed I think New York will be very well off as regards locomotion—better than any city that I know of. All the work upon it is absolutely first-class, the actual construction, materials—everything. As soon as the people have forgotten the inconvenience they have suffered, and that will not be very long, they will be very proud of it.

"I have been all over the elevated system," he said. "You get a very good rate of speed on that, I notice. I was interested, too, in the tramways. They are just getting some roads built in London with the underground construction, or sub-trolley, such as are in Broadway. The thing that astonished me most of all in New York was this: I went down to Thirtieth Street and Broadway the other morning at 9.30 o'clock to take a car to the lower city. Just as I got there a man with a double team and a cart filled with bricks threw his horses right across the down road surface cars. As it seemed to me a very extraordinary thing, I took out my stop watch to see how long he was going to stay there and block traffic, and he did it for eight minutes, stopping all cars going down at that busy hour of the morning. I think it was perfectly scandalous. Now, is that a usual thing in New York? I think if a man did that in London he would find himself in jail before much time elapsed."

Mr. Fitzmaurice said that he thought the subway would be perfectly safe, and that there would be no possibility of a repetition of the Paris horror beneath the streets of New York.

Taxation of Telephone and Telegraph Companies in Indiana.

The growth of the telephone business in Indiana is reflected in the figures taken from the report of the State Tax Board, which has recently completed the appraisement of the telephone companies over which the board possesses original jurisdiction in fixing assessments. There are 191 companies coming under the board's jurisdiction and these companies are compelled to bear a large increase of taxation. The total appraisement of the telephone companies was fixed at $6,819,552, an increase of $1,775,973 over last year. The increase is largely due to the building of additional lines, the rate of assessment and valuation of individual companies having been increased in many cases. The assessment and valuation of telephone property by the board is exclusive of real estate, structures, machinery and appliances. These are subject to local taxation.

There is a total of 127,287.54 miles of telephone wire in operation in the State. The lowest assessment against any company is $5 per mile, and the highest is $600 per mile. The telephone companies throughout the State will generally pay increased taxes under the assessment. The Central Union was raised $2 a mile, bringing its assessment up to $56 a mile. The company has built nearly 2,600 miles of line and this will bring its total appraisement up to $3,135,290, an increase over last year of $801,559. The New Telephone Company will pay taxes on $196,250, an increase of $9,750. The increase is made up because of the additional mileage, as the rate was reduced from $150 to $140 per mile. The appraisement of the New Long-Distance company remains at $25 a mile. With the increased mileage this will bring its appraisement up to $383,320.

The telegraph companies' assessments were reduced $552,201. The Western Union reduction was the greatest. Its assessment of $57 a mile, as fixed last year, was reduced to $40 per mile. With an increase of nearly 4,000 miles of line, its assessment will be reduced $503,280. The Postal Telegraph Company's reduction is $40,302, or $5 per mile. These reductions were made on the plea of decreasing business due to telephone competition.

CURRENT NEWS AND NOTES.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—Mr. La Rue Vredenburgh has accepted an appointment as reporter on advertising methods, and will present at the twenty-seventh convention of the National Electric Light Association, to be held in Boston next May, a very elaborate report of the most novel and striking features in this department of electric lighting. Mr. Vredenburgh is in charge of the Edison Electric Illuminating Company's exhibition department in Boston, which is one of the most complete of the kind in this country. The Wrinkle Department will be in charge of Mr. Charles H. Williams, of the Madison Gas & Electric Company, Madison, Wis. This department was suggested by Past President Doherty, and it is safe to say that the efforts of Mr. Williams will continue the value and interest which this important department has had to the members of the association.

WIRELESS TELEGRAPHY.—Mr. James T. Allen, examiner in the United States Patent Office, and the well-known compiler of patent digests, is engaged in compiling a digest to embrace the United States patents for wireless telegraphy under 15 subdivisions from 1,789 to date. The work is to include the full drawings, specifications, claims and also a list of the references cited while the applications were being examined, and in interferences and decisions. The great merit of Mr. Allen's previous publications is an indication of what may be expected in this latest work, which should be of the greatest value to all those interested in the subject of wireless telegraphy. Those desiring fuller information should address Mr. J. T. Allen, Room 321, United States Patent Office.

MARCONI GOING TO ST. LOUIS.—Mr. Marconi has, according to the *Wall Street Journal,* decided to go to St. Louis on the invitation of the Executive Committee of the St. Louis Exposition, tendered through Gov. Francis. After several days he expects to return to Cape Breton, there to begin the work of installing his new inventions, by means of which the height of the towers necessary for transatlantic transmission will be reduced over 50 per cent. It is his intention hereafter to divide his time about equally between the English and American stations for the purpose of securing the equipment and perfection of the same for the commercial transmission of messages across the Atlantic. "My consultation with Mr. Edison," Mr. Marconi says, "was highly satisfactory, and will, I hope, be productive of good results. I am highly pleased with Mr. Edison's hearty co-operation in the matter of the development of my system, and certainly expect the very best results will be obtained therefrom. The Marconi Company now has the expert services of the leading men in this line of thought in the world, in addition to my own. The question of interference, of which so much has been made by the press," Mr. Marconi continues, "is one which is really entitled to no serious consideration. Efforts to impede the operation of the wireless system can only be compared to the efforts of persons to destroy telegraphic communication between two points by grounding the wires. It is an operation which may be conducted in safety for a short time, but sooner or later detection and punishment follow. It is not a very satisfactory thing for a corporation or an individual to spend money merely for the prevention of an accomplishment by some rival whom they cannot meet in a fair competitive field, and will not be persisted in very long in the absence of any profit arising from such action. It is the policy of the Marconi companies to go quietly about their own affairs, without attempting to impede or annoy by placing obstacles in the way of its so-called rivals, and we believe that this policy will in the long run win out."

TROLLEY CURRENT COLLECTOR.—A patent granted August 25 to R. A. Emil Huber, of Zurich, Switzerland, describes a trolley current collector consisting of a curved arm having a motion in a plane at right angles to that of the trolley line. The arm is mounted on the side of the car near the top, the table carrying it being capable of vertical adjustment by means of a screw spindle. The curved arm can take a position suitable for making contact with a trolley wire above the center of the car or one alongside the car, or in any location intermediate of these limits.

MASSENA-MONTREAL TRANSMISSION.—It is stated that the city of Montreal is to have a new power company, through the efforts of Mr. McLea Walbank, formerly managing director of the Lachine Hydraulic Power Company. The company promoted by Mr. Walbank will bring in the power from Massena, N. Y., and, according to the survey made, the distance from the power there to the distributing station in Montreal will be 78 miles. The examinations already made show that between 25,000 and 40,000 hp can be secured according to the location that is secured. The announcement is made that Mr. Walbank, who is now in London, England, has been successful in securing the capital necessary to organize the new company.

MORE IMPROVEMENTS AT NIAGARA FALLS.—The upper power district at Niagara Falls, N. Y., is to receive another impetus, in the increase of the plant of the Oldbury Chemical Company, which is about to build four separate factory buildings on the property directly opposite the present plant. Contracts have already been let, and the work will be started immediately. These buildings will be of regulation factory building height, about 45 ft. in width, and from 100 to 125 ft. in length, and will cost from $20,000 to $25,000. They will be constructed of brick and iron, and the work will be pushed forward rapidly. The Oldbury Company is now rebuilding the structure recently destroyed by fire, and also erecting a new office building. When all its additions are finished, their plant will be one of the city's largest industries.

RADIUM FOR TESTING GEMS.—The American Museum of Natural History in New York City has received a quantity of radium which is not very large, but the radioactive power of which is second to none in this country. It was given to the Museum by Mr. Edward D. Adams, whose immediate object is to enable George F. Kunz, the gem expert, and Dr. Charles Baskerville, of the University of North Carolina, to carry on some experiments with gems. Mr. Kunz is very much interested in discovering the properties of the new gem, Kunzite, which is named for him, as noted recently in these columns. It is reported that this gem is very phosphorescent when exposed to the radium rays. A beginning has been made in the examination of the Bement-Morgan and Morgan-Tiffany collections of gems with the X-ray and radium rays. A report of the results will soon be made in a special publication of the museum. The specimen of radium which has been imported for the museum is of 300,000 radioactivity.

ALL-ENGLISH TELEGRAPH AROUND THE WORLD.—At the recent meeting in Canada of the Congress of the Chambers of Commerce of the British Empire, a resolution, offered by Sir Sandford Fleming, of Ottawa, was adopted expressing the opinion that all the self-governing British communities around the globe should be united by a continuous chain of state-owned telegraphs. In moving the resolution Sir Sandford said that there should be a continuous chain of state-owned electric telegraph girdling the empire and encircling the globe so that in the event of interruption from any cause, telegraphic communication may, nevertheless, be maintained by sending messages in the opposite direction; that submarine portions be laid, for better security, in deep water; and that no part of the electric telegraph circle touch land which is not British. The new Pacific cable is regarded as part of the chain. The cost involved in completing the whole scheme is estimated at about $20,000,000. It would be owned by Great Britain, Canada, New Zealand, Australia, India and South Africa.

ARTIFICIAL GUTTA PERCHA.—Mr. O. J. D. Hughes, United States Consul-General at Coburg, Germany, says: "A new concern has been started in England, with a branch in Germany, to manufacture artificial gutta percha under "Gentzsch" patents and rights. If the material should, indeed, realize the eminently satisfactory reports which have so far been obtained, there ought to be a very large market for this product, especially in view of the ever-increasing demand and the shrinking supply of the natural product. A well-known European expert is quoted as saying: 'I have recently had an opportunity of seeing some further results obtained by the German post office with submarine and land cables insulated with this new dielectric, and these results fully bear out the claims made by the inventor for the favorable qualities of his products.' It is especially worth noting that this official report amounts to a complete confirmation of the extremely favorable properties of the new gutta percha as regards its high insulation resistance and an inductive capacity considerably lower than that of the natural product."

"A DIABOLICAL MACHINE."—An amusing story is told of the failure of an attempt to establish a telephone service at Saint-Etienne des Gres, situated in the Tarascon district of France. The necessary apparatus had been packed all ready to start for the village when the carter heard that the inhabitants, being under the odd impression that the invention was the work of the Evil One, were determined to oppose its entry, and were resolved to arm themselves with their agricultural implements and to make a fight of it. The man said that he was willing to confide his cart and its contents to the electricians, but that as for himself he would not risk his life in such an adventure. A telegram was forwarded to Marseilles asking for instructions, and the reply came that the cart was to be left at Tarascon. What the sequel to the present deadlock will be remains to be seen; but meanwhile the good people of Saint-Etienne des Gres stoutly declare that they will have nothing to do with the telephone, which is "a diabolical machine." Is this another hoax on the provencal district which so bitterly resented Daudet's "Tartarin de Tarascon?"

S. R. A. N. Y.—The twenty-first annual meeting of the Street Railway Association of the State of New York is to be held at the Yates Hotel, Syracuse, N. Y., on October 6 and 7. The meeting is called a month later than usual on account of the close proximity of dates of the American Street Railway Association meeting at Saratoga. In view of the change of dates the Executive Committee of the State association appreciate the necessity of even a more determined effort than they have put forth heretofore to secure the desired large and representative attendance of both street railway and supply men. An unusually interesting meeting is anticipated. Numerous papers upon important street railway subjects will be presented and topics of general interest and profit will be thoroughly discussed. In addition to the business features of the meeting an excellent programme of entertainment, including the annual dinner on Tuesday evening, October 6, has been arranged by the local committee. Mr. G. Tracy Rogers, of Binghamton, is president.

GOVERNMENT OWNERSHIP.—Mr. R. T. Snedeker, of Kansas City, an ardent supporter of the single-tax theory, recently wrote a letter to Charles Francis Adams, of Boston, on the question of municipal ownership of street railway lines. Mr. Adams's letter in reply to Mr. Snedeker is as follows: "I can only say that, as the result of careful official examination on my part, I have never yet found in Europe anywhere a case of municipal or public transportation worthy of an instant's consideration as compared with our own. Whatever complaints you may make of it—private monopoly and all that—we here in America do things in the transportation line which in Europe they do not even dream of. Under the circumstances do not look for sympathy from me in a movement in that direction. The fact is, when it comes to handling private business, any and every government is, in my opinion, utterly incompetent, whether it is water system, schools, railroads, telegraphs, post offices or what not. Every time private enterprise would do it four times as well, at about half the cost. So far as I know, experience is uniform in this respect. Look at our school system. It is one mass of jobbery from beginning to end. The politicians and jobbers are always worming into them. If you are looking for another object lesson, study the Government Printing Office at Washington. Every document published—lumbering, clumsy, useless—costs notoriously twice what it would cost if issued by a private press. And the Post Office. Just look at the system of fraud, bribery and stealing now being brought to light. Please don't talk to me of doing business through governmental machinery. It is one colossal exhibition of waste, extravagance and incompetency."

GERMAN HIGH SPEED TRAINS.—The German Reichstag has voted $70,000 for a new track, to be laid upon the Berlin-Zossen line, for immediate experiments with electric trains. This is the outcome of the late well-known experiments, during which a train, for a brief period, attained a speed of nearly a hundred miles an hour.

AN OUNCE OF RADIUM.—According to the *Anglo-Indian Review*, it having been calculated that the energy stored up in one gram of radium is sufficient to raise 500 tons weight a mile high, an ounce would, therefore, suffice to drive a 56-hp motor car at the rate of thirty miles an hour around the world. The calculator evidently confused intrinsic energy with capacity for transforming energy.

MODERN SCIENCE CLUB.—On September 8 there will be a general discussion of the subject of electric elevators before the Modern Science Club, 125 South Elliott Street, Brooklyn, N. Y., and some short papers on the theme are to be read. On September 22 Mr. J. A. Anderson will give a lecture on the Eastern Power Station of the Brooklyn Rapid Transit Company. Mr. R. Henderson is secretary of the club.

WIRELESS TELEGRAPH CONVENTION.—A cablegram from Berlin reports that the delegates of nearly all the countries which participated in the recent International Congress of Wireless Telegraphy in that city, whose sessions were secret, favored international control of wireless telegraphy and advocated that no land station shall refuse to take a message, if comprehensible, from any ship using a system different from that of the company owning the station.

WESTON STANDARD CELL.—In referring to the Weston cadmium cell in an editorial in our issue of August 22 entitled "The Legalized Standard of E. M. F.," by a slip of the pen this cell was stated to be a zinc-cadmium combination. As is well known, in the Weston cell the zinc of the Clark cell is replaced by cadmium, the other element in each being mercury. Correctly speaking, the Weston cell is a cadmium, amalgam-cadmium, sulphate-mercury combination.

A LIGHTNING CONDUCTOR.—An interesting episode is thus noted by the St. Louis *Globe Democrat:* "Some kind of a memorial should be presented to the engineer of the cogwheel railroad on Pike's Peak. Being struck by lightning and stripped of his clothing, he calmly attired himself in a Navajo blanket and continued his duties. We must ever feel an unquenchable admiration for such sprightly unconcern. It is quite customary when struck by lightning to make a great fuss about it; to demand the services of everybody in the neighborhood for our resuscitation and to bring the business we may have had in hand to a dead standstill."

INTERNATIONAL WIRELESS TELEGRAMS.—A special dispatch from Washington, of September 3, says: "The final protocol of the international wireless telegraph conference, held in Berlin last month, was made public to-day at the State Department. Gen. Greely was chairman of the American commission. This commission had no authority to make any agreement for the United States, but the protocol embodies in most of the essential features the views expressed by the American commissioners. Another conference will be held, and if all delegates have full powers the protocol no doubt will be embodied in a treaty for the government of international wireless telegraph communication.

THE RAOUL SUBMARINE.—The Lake submarine boat for sponge and pearl fishing is familiar to Americans. Experiments are now being made at La Goulette, Tunis, with a vessel, invented by Abbé Raoul, the Vicar-General of Carthage. It is made of steel, and resembles a huge porpoise. The entrance to the central chamber is hermetically closed by a heavy lid fastened with screws, and the occupants survey their surroundings through four portholes. A long spear terminating in a grappling hook, worked from the interior, seizes the sponge and deposits it in a net at the side of the vessel. The craft is propelled by accumulators through a cable attached to a vessel on the surface, with which it is also in communication by telephone. It is lighted by electricity, and a lamp hanging in the bow lights up the water bed for the sponge fisher.

EXPLOITING POPOCATAPETL ELECTRICALLY.—It is stated from the City of Mexico that the American syndicate which has just closed negotiations for the purchase of Popocatapetl volcano from Gen. Gasper Sanchez Ochoa plans to spend several million dollars in making their purchase of commercial value. It is said that in addition to the construction of a cog-wheel railroad from the base to the mouth of its crater, a hotel will be built on its summit at an altitude of 18,000 feet. The most important adjunct of the proposed enterprise, however, is the establishment of a gigantic electric power plant on Mount Ixtaccihuatl volcano. The syndicate has acquired valuable water rights on the latter, and the power will be transmitted to Mount Popocatapetl and used to operate the cog-wheel road and the hoisting machinery which is to be installed to get the sulphur out of the crater. It is also proposed to construct electric elevators in the crater by which sight-seers may descend several thousand feet and get a view by electric light of the great subterranean cavity. An electric elevator running "several thousand feet" would be worth going anywhere to see.

RÖNTGEN RAY TANNING.—It is stated from Cincinnati that experimenting has resulted in the discovery of a process of tanning, by means of which hides can be transformed into leather in a short time by the use of the X-ray. The hides will be soaked in lime for the separation of the fibres and removal of the hair, as is done now. When this has been completed, which usually requires about four days, the hides will be soaked in a solution of certain chemicals, a part of the invention, for about two hours, and will then be exposed to the X-rays for about fifteen or twenty minutes, which will thoroughly tan them. The finishing will then proceed in the way employed at present. Under the new system the chemicals absorbed by the hides during the two hours' soaking are said to be decomposed by the X-ray in less than half an hour. After the hides have been soaked in the solution they are put on a highly polished steel plate and a series of three tubes diffuse the rays upon their entire surface. They remain in this state for about twenty minutes, when they are ready to finish as usual into enamel, patent leather or any desired article. The great difficulty which the inventors met was to obtain a ray sufficiently strong to penetrate the entire hide. Now, twenty hides, one on top of the other, can be "rayed" at once. The inventor asserts that not only will this new process reduce the time necessary for tanning from four months to four days, but it will also reduce the cost of manufacture fully 75 per cent. As if this advantage were not sufficient, it is added that the cost of fitting up a plant necessary for the working of the process is only one-fourth the cost of erecting a plant under the present system.

LETTER TO THE EDITORS.

Wireless Reporting of the Yacht Races.

To the Editors of Electrical World and Engineer:

SIRS:—The history of reporting the recent international yacht races by wireless has demonstrated what was already apparent to most experts—the advantage of powerful apparatus; the incontestable superiority of the telephone receiver over the coherer and tape, and that certain ancient traits of human nature will crop out in any new field of competition.

As was to be expected, the syntonic system of which much has been heard of of late years, seems to have failed more or less completely under the attack of a 10-hp outfit on board a brick schooner. Yet with skilled operators using a responder and telephone, it was possible to easily read either of three different transmitters so long as these differed essentially in spark frequency, speed and style of sending. With the syntonic device which I have been using of late, it is practical to cut out all but the desired signal, or at least reduce the interfering sound to the desired extent. I am at work on further perfections of this method by which all but the most powerful atmospheric disturbances, such as from an electric storm directly overhead, conditions or interference which would render any telephone or telegraph line inoperative, can be cut out from the receiving instrument.

While it is well for lawyers at this time to consider carefully means for prevention of malicious interference with commercial wireless, especially when the interference is on a boat outside the three-mile limit (conditions which will obviously require special and international legislation), it is more fitting for the wireless expert to devote his attention to the technical and scientific remedies rather than to howl for the aid of the law.

The company that had the most to say against wilful interference during the races have been only getting a taste of their own medicine; when news of as vital and widespread interest as that of the *Erin's* approach to these shores was being received at our Coney Island station, the Marconi operator at Babylon kept his key depressed for minutes at a time in a futile attempt to break up communication.

Our stations at Block Island and Point Judith, through which the *Providence Journal* is publishing a daily newspaper on Block Island, frequently note apparent attempts at unnecessary interference from Sagaponack and Nantucket, yet the service there has been maintained from the start uninterrupted by these neighbors or by any passing boats, and from 2,000 to 4,000 words are transmitted regularly each night.

The same brick schooner tactics, more relentlessly pursued than at the yacht races, have been practised at the Chicago stations of the English company for some time, and it is not without thought of the Pharisees' unworthiness to "cast the first stone" that we listen to the charge of unfairness.

The past two years has demonstrated that the De Forest system has little to fear from interference from stations in legitimate commercial rivalry, and the yacht race incident has furnished in this country an object lesson similar to that which Mr. Maskelyn has recently contributed in England. It should serve as a stimulus to more refinement in wireless syntony and courtesy than practice has in some cases hitherto shown.

NEW YORK CITY. LEE DE FOREST.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Dielectric Hysteresis Loss and Capacity of High-Tension Machines.—HOLITSCHER.—A long article, in which the author gives the results of an investigation to determine the hysteresis loss in the micanite tubes of high-tension machines, carried out with a 500-hp polyphase synchronous motor of 10,000 volts. The method consisted in connecting one terminal of the high-tension winding of a transformer with the iron of the machine to be tested, while the other terminal is connected to the coils of the machine. The individual phases are arranged parallel to each other at the connected end, while the other end is left open. The machine acts like a condenser, one layer of which is represented by the iron surface of the slots, while the other layer is formed by the copper coil, and the dielectric by the micanite tubes. The experiments were carried out at 53.3 cycles, with voltages varying from 5,000 to 21,500 volts. The watt losses in the low-pressure winding of the transformer were measured, and after disconnecting the machine, the iron losses of the transformer and the losses in the measuring instruments were measured under the same conditions. By subtracting these, the hysteresis loss of the machine under investigation at the different pressures is found. The author gives the results of his investigation in detail, with the curves. He finds that the losses are approximately proportional to the number of periods, and a loss from leakage by conduction can be neglected relatively to the hysteresis loss. The capacity and therefore also the dielectric constant of the material under investigation (micanite) is absolutely not a constant quantity. It changes with the electrostatic load within appreciable limits. On account of the lack of knowledge of the variation of the capacity, the increase of the dielectric hysteresis loss with increasing potential cannot be determined in advance. The usual law, hysteresis loss $= C E^2$ only has a limited application, with materials the capacity of which does not change, or with small electrostatic loads. In high-pressure machines with micanite tubes, the dielectric hysteresis loss at higher strains of the micanite is approximately proportional to the third power of the tension. In the determination of the efficiency of a high-tension machine, the dielectric hysteresis loss can be neglected, as the materials are mostly quite thick on account of safety against perforation; the strain is, therefore, small.—*Elek. Zeit.*, August 13.

Hunting of Alternating-Current Machines.—HOPKINSON.—The conclusion of his article previously noted in the Digest. The theoretical results developed in the first part have been confirmed in a general way by experiments on a small alternating-current motor, separately excited. The various constants of the machine were determined and it was found that with the motor connected directly to the 94 to 98 volts, 50-cycle mains, it should be expected to be violently unstable; this was found to be the case. When the machine was connected directly to the mains as a motor with an exciting current of 30 or more, it very rapidly developed oscillations and finally dropped out of step altogether. The oscillations occurred just the same whether a large or small generator was working at the power station. They were not affected by putting heavy rings of copper around the pole-pieces in addition to the field winding. It was only by reducing the field current to 13.5 and loading the machine with a brake until the applied power was about 1,800 watts, that the "hunting" could be stopped. By inserting self-induction in series with the motor, the violence of the "hunting" could be gradually diminished; and at the same time its period could be gradually increased from about 0.35 to 0.45 second. With external self-induction giving a total reactance of about 3 ohms and resistance of 1.2 ohms, the stability depended on the load and on the exciting current; particulars of the experiment are given. Measurements and calculations of the coefficient of instability and the damping coefficient are given. The effect of increasing the dimensions of the machine on the results obtained is also discussed.—Lond. *Elec.*, August 14.

REFERENCES.

Design for a 1-Hp Self-Starting, Single-Phase Induction Motor.—An illustrated article giving all the essential features of a self-starting induction motor capable of giving one brake horse-power on a single-phase circuit of 100 volts and 125 to 133 cycles, the speed of the machine depending, of course, primarily upon the frequency of the supply current. The synchronous speed at 125 cycles is 3,750, and at 133 cycles it is 6,400 r.p.m. The drawings are all dimensional, and all the information necessary for the construction of the motor is contained in the article.—*Amer. Elec.*, August.

Construction of Direct-Current Machines.—DICK.—A mathematical article, in which the author lays down some conditions and formulas, which illustrate in a comprehensive manner the changes in the dimensions of the armatures with different numbers of poles, assuming a certain coefficient of air-induction and a certain form of the pole shoes.—*Zeit. f. Elek.*, August 16.

Management of Alternating-Current Machinery.—HANCHETT.—A popular discussion about running alternators in series and parallel.—*Central Station*, August.

Speed-Regulation of Direct-Current Motors.—ROGERS.—A review of several methods for speed control of stationary and traction motors.—Lond. *Elec. Eng.*, August 14.

POWER.

Electrical Plant Failures, their Origin and Prevention.—CAMPBELL CORMACK.—A paper read before the English Institution of Mining Engineers. The author gives an analysis of the break-downs which have occurred to several thousand electric machines ranging in size from an 800-kw dynamo to a ½-hp motor, the period of observation extending over about four years. He gives a table showing the relative frequency with which various portions of dynamos and motors were damaged, when break-downs occurred. He finds that the mechanical portions were responsible for 25.05 per cent., the brush-gear, terminals, connections, etc., for 7.01 per cent., the field magnet coils for 10.16 per cent., the armatures for 78.15 per cent. and the commutators for 33.6 per cent. When the accident was of a compound nature, several parts being injured, each is included in the table. The failures of the armature constitute the largest item, 29

per cent. under this heading being due to burning out, 19.5 per cent. were due to earthing through failure of insulation of the frame, and 15.6 per cent. to breakage of the wire. A second table shows the portions of the machines at which the break-downs originated, or the portions which, by being faulty, caused the break-down. The items include mechanical portions, 11.03 per cent.; brush gear, leads and terminals, 8.6 per cent.; field magnets, 8.58 per cent.; armatures, 47.87 per cent.; commutators, 14.9 per cent.; starters, 4.7 per cent.; unknown, 3.13 per cent., and various, 1.56 per cent.; these, except the last three, are still further subdivided. A third table shows the causes to which derangements were due, 39.36 per cent. of which are attributed to constructional causes, including 18.36 per cent. of bad design, 7.4 per cent. perishing of insulation, and 13.6 per cent. bad workmanship; 3.71 per cent. are conditional causes, 1.37 per cent. of them being due to overloading, 1.56 per cent. to overrating, and 0.78 per cent. to unsuitability. Maintenance is credited with 31.46 per cent. of the causes, among which are dust and dampness, 7.4 per cent.; rough usage, 1.56 per cent., and defective attention, 22.5 per cent. There are 7.05 per cent. accidental and unavoidable causes, with reasonable care in construction and working, unknown causes, 13.1 per cent., and 5.48 per cent. caused by faults in accessories. The author states that the great majority of the faults in design appear to be in the electrical portions of the machines, and for the most part take the form of supplying too little insulation, insufficient insulating ridges, and improper arrangements for supporting the conductors and their insulation. The author is afraid that, owing to the stress of competition, a number of designers sacrifice to a great extent reliability to cheapness, particularly in the case of small and medium-size motors, the tendency being to design machines having higher rises of temperature than experience has shown to be compatible with reasonable durability of the machine. The author states that these statistics are compiled from machines, the superintendence of which is somewhat better than the average, and, owing to the elimination of a number of very bad machines, the plants are considerably better than the average. The results are discussed in detail.—Lond. *Elec.*, August 14; reprinted in *Eng. News*, September 3.

Electrical Driving of Winding Gears.—HIRD.—A paper read before the recent London meeting of the English Institution of Mining Engineers. The author first discusses the Siemens-Halske system of electric hoisting, in which a battery of accumulators is used as an equalizer of the load. He then describes in detail the Siemens-Ilgner system, which makes use of a high-speed fly-wheel to provide the necessary storage of energy. The system consists of the following parts: 1, a motor capable of furnishing the average power required by the winding gear; it may be a three-phase induction or direct-current motor; 2, a direct-current generator, which furnishes the current for this motor, the machine being so arranged that the excitation of its field is variable from its full maximum through zero to its maximum in the opposite direction. By this means the supply voltage to the motor can be varied through the same range; 3, a small direct-current machine serving as exciter for the generator and the winding-gear motor. This special exciter is necessary to insure stability of the field, which could not be attained through such a wide range if the generator furnished its own exciting current; 4, a heavy steel fly-wheel, specially designed for high-circumferential speeds, so as to store a large amount of energy in proportion to its weight. The current from the generator is taken directly to the armature of the motor driving the winding drum, without passing through any switches, fuses or controlling gear. It is claimed as one of the special advantages of this system that no manipulation of the heavy main current is required, the whole of the control being effected by light switching gear dealing only with the small currents for exciting the field magnets. An ingenious automatic system of regulating the speed of hoisting, providing amply for security and guarding against misuse or negligence, is described at length. The action of the fly-wheel, being an important feature of the system, is discussed. When the lift commences, the power is at first supplied entirely by the generating station, but as soon as the demand has become greater than the average, the motor generator begins to slow down and its fly-wheel furnishes the excess of power required; as soon, however, as the demand for power has again fallen below the average, the motor-generator begins to speed up again, storing energy in its fly-wheel. It continues to do so after the completion of the trip and before the next lift begins, drawing this power from the generating station and providing it with a load during the period of rest. The author then takes up the question of steam consumption, actual trials of steam hoisting engines having shown a consumption of 114 to 77 pounds per effective hp-hour under ordinary conditions of operation. With a fair average steam consumption of 20 pounds of steam per electrical hp-hour and assuming an efficiency of only 50 per cent. of the motor-generator, he deduces for the Siemens-Ilgner system a steam consumption of only 40 pounds of steam per effective hp-hour of the useful load. No negligence of the operator can appreciably affect this figure, as the steam distribution in the cylinders is entirely beyond his control. The author states that broadly speaking the cost of an electrical winding plant, with motor generator and all controlling devices, would be about the same as that of a good modern steam winding plant of the same capacity.—Lond. *Elec.*, August 14.

Electric Motive Power in Mines and Collieries.—SCOTT.—A long abstract of a paper read before the South Wales and Monmouthshire Institute of Engineers. The author reviews in general the conditions of electric motive power and calls attention to the employment of a suitable starter. The question of insulation is then taken up and the author states that during many years of experimenting he has found cables insulated with bitumen to answer best for mining purposes. Motors are then discussed and it is stated that the polyphase type of motor best suited for mining purposes was the induction motor. The squirrel-cage motor had been advocated for all mining work, but in the author's experience, for motors over 10 hp, the slip-ring motor with cased brush gear, was far more satisfactory, and the additional risk introduced by the slipping was practically negligible. As to the best type of generating plant suited to colliery work, the type of engine most favored by engineers is stated to be the horizontal slow-speed coupled compound. The pros and cons for high or low-speed engines are discussed at length, as is also the question at which distance from the boilers it becomes better practice to adopt an electric motor in place of a steam engine. The approximate cost of generating electric power is then taken up and figures obtained in actual practice on a large scale are given. The other incidental advantages of the use of electric power are set forth in conclusion.—Lond. *Elec. Eng.*, August 14.

Boring and Turning Mill for Electric Generators.—A well-illustrated description of a tool recently built for the Allgemeine Electricitäts Gesellschaft, Berlin, and specially designed for large dynamo work. Dynamo housings to be turned are mounted on an outer base plate, which surrounds a rotating face plate with four tool-carrying columns. In turning armatures, the arrangement is reversed, the armature being bolted to and rotated with the face plate past the stationary tools which are now transferred to the outer fixed plate. All the setting and feeding motions are accomplished by electric motors. In order to be able to center a housing, without applying pressure to it and thus cause a deformation, an arrangement is made by which the face plate on which the housing rests can be moved in any direction.—Lond. *Eng'ing*, August 14.

REFERENCES.

Simple Prony Brake.—An illustrated article describing a very simple and substantial form of Prony brake.—*Amer. Elec.*, August.

Motor-Driven Mine Hoist.—An illustrated description of a small, compact and portable machine. The motor is of 7½ hp, 220 volts, drawing at full load a current of 30 amp. The controller allows twelve speeds in either direction.—*Eng. & Min. Jour.*, August 29.

TRACTION.

New Single-Phase System for Electric Traction.—An article describing the Westinghouse installation for the Baltimore, Washington & Annapolis Electric Railway. The type of motor is similar in general construction to a direct-current motor, but with its magnetic circuit laminated throughout and with such properties that it can successfully commutate alternating current. Curves for the power factor, the efficiency, the armature speed and the torque are given. The motor is a plain series motor, which can be operated on either alternating or direct currents and will have the same torque characteristics in either case. Single-phase, alternating current will be supplied in the operation of the road to the car at a frequency of 16⅔ cycles per second, the current from the overhead trolley wire being normally fed by one trolley at approximately 1,000 volts. The alternating current to the car is carried through a main switch or circuit-breaker on the car to an auto-transformer, connected between the trolley wire and the return circuit. At approximately 300 volts

from the ground terminal, a lead is brought out from the auto-transformer and passes through an induction regulator to one terminal of the motors. For starting and for controlling the speed, the regulator is used with its secondary winding in series with the motors. This secondary circuit of the regulator can be made to add to or subtract from the transformer voltage, thus raising and lowering the voltage supplied to the motors. The range of voltage at the motor is to be varied from 200 up to 400 volts, or slightly higher. The transformer will supply 315 volts and the secondary regulator circuit will be wound to generate a maximum of slightly more than 100 volts. There will be four motors of 100 hp each on each car, the full rated voltage of each being approximately 200 volts. They will be arranged in two pairs, permanently connected in parallel, each consisting of two armatures in series and two fields in series. To insure equal voltage to the armatures in series, an equalizing action is obtained by the use of a small auto-transformer, connected permanently across the two armatures in series with its middle point connected between them. The fields are arranged in two pairs, with two fields in series and two in multiple. This parallels the fields independently of the armatures, so that one reversing switch may serve for the four motors and one balancing transformer may be used across the two pairs of armatures. The armature and field being connected in series, the entire current of the field passes through the armature as in series direct-current motors. The motor has eight poles and eight field coils, the latter wound with copper strap. The speed is approximately 650 revolutions at 200 volts. The difficulty of sparking has been overcome by so constructing the motor that the secondary or short-circuit current in the armature coil is small, and the commutating conditions so nearly perfect that the combined working and secondary currents can be commutated without sparking. The induction regulator or controller resembles an induction motor in general appearance and construction, the primary winding is placed on the rotor and the secondary or low-voltage winding on the stator. The rotor also has a second winding, which is permanently short-circuited on itself, its function being to neutralize the self-induction of the secondary winding as it passes from the magnetic influence of the primary.—*St. R'y Rev.*, August 20.

Modern Railway Power Station.—VIALL.—An illustrated article describing the new high-tension, alternating-current installation of the Berkshire Street Railway Company. Three-phase current of 13,300 volts is generated at the central station at Pittsfield and transmitted directly to the transmission lines without the use of step-up transformers; one sub-station is 10 and the other 25 miles distant. This current is stepped down to 380 volts for use at the two 300-kw rotaries in the main station and two 250-kw rotaries in each of the two sub-stations, which deliver direct current at 600 volts to the trolley wire. The main generating units comprise two 750-kw, three-phase, revolving-field alternators delivering current at 25 cycles per second. Each alternator is excited by its own exciter set, consisting of a 20-kw, 125-volt, direct-connected generator. The electrical equipment of both of the sub-stations is identical. The transmission lines which are in duplicate are all bare copper wire carried on two cross arms, one circuit being carried on each side of the pole. Each circuit is arranged in the form of an equilateral triangle with sides 18 in. long. The insulators for the high-tension lines are of glass, having 7½-in. petticoats and supported on steel pins with glass sleeves. An electric signal system is described in detail, which is used on the line to show whether the section to the next turn-out is free or not.—*Amer. Elec.*, August.

Combined Railway, Lighting and Ice Plant.—An article describing the power plant of the Norfolk, Portsmouth & Newport News Company, at Hampton, Va., which combines a railway, lighting and ice-making station. The station is designed for a capacity of 2,625 kw in generating machinery and two 40-ton refrigerating machines. There are three alternating-current machines aggregating 1,300 kw, and two railway units with space for a third, giving a total of 1,325 kw. The smaller railway set comprises a tandem-compound engine and a direct-connected, 325-kw generator run at 100 r.p.m. The second railway unit has a cross-compound Corliss engine and a 500-kw generator at 90 r.p.m., while the third unit, which is yet to be installed, will be of the vertical type and of 500-kw capacity. Three alternating-current generators furnishing current at 3,450 volts and aggregating a capacity of 1,300 kw, comprise the lighting and power outfit. One cross-compound engine operating at 120 r.p.m., and two tandem-compound engines running at 150 r.p.m., are directly connected to these lighting machines.—*St. R'y Jour.*, August 15.

Utica & Mohawk Valley Railway.—An illustrated description of the system. At the Utica sub-station there are three 550-kw, oil-insulated, self-cooling transformers connected in delta, which reduce the 20,000-volt current to 360 volts, at which pressure it is delivered to one 500-kw and two 300-kw rotary converters. The rotaries operate over a common set of bus-bars and have no choke coils or inductance in the alternating-current leads. They deliver 600 volts direct current, which is sent out to the trolley line. In case of trouble, any transformer can be disconnected and the rotaries operated on the remaining two transformers connected in V. The arrangement of the apparatus in the other sub-stations is similar.—*St. R'y Jour.*, August 29.

Motor Trucks for the New York Subway.—An article describing and illustrating the design of the motor trucks for the subway equipment of the Interborough Rapid Transit Company of New York. Three hundred and fifty of these motor trucks will be built for the initial installation; half of them will carry Westinghouse and the other half General Electric railway motors, of 200 hp. Nose suspension will be employed in all cases, with a different arrangement, according to the construction of the motors. Particulars of this construction are given. The trucks will be unusually heavy and have been especially designed for severe service.—*St. R'y Jour.*, August 15.

Pneumatic and Electric Locomotives in and About Coal Mines.—ACKERMANN.—A short paper, with discussion, read before the recent meeting of the English Institution of Mining Engineers. The author enumerates the advantages of the electric locomotive as compared with the pneumatic; it is smaller, the installation of the system is easier and its efficiency is considerably higher than the latter. In the discussion a member mentioned the fact that he had replaced a 70-hp compressed air pump by a 12-hp electric pump and the latter did three or four times as much work as the former.—Lond. *Elec.*, August 14.

REFERENCES.

The Hudson Valley Railway.—A description of this line, whose power equipment comprises five generating stations, combining water and steam plants, and six sub-stations.—*St. R'y Jour.*, August 29.

Shock from High-Voltage Locomotives.—An editorial discussing the possibilities of receiving shocks from high-voltage locomotives when the latter are run on rails which are covered with sand or otherwise partly insulated; in such a case there is a dangerous voltage between the frame of the locomotive and the ground, and persons entering the locomotive are liable to receive shocks.—*St. R'y Jour.*, August 22.

Progress in Underground Electric Railways in London.—A short sketch of all of the underground electric railways in London, and particulars of the power station of the Metropolitan Railway, which is distinct from that of the Metropolitan District Railway. The station will contain four 3,500-kw steam turbines, directly-connected to generators, and provision has been made for an extension to contain two more sets. Power will be distributed at 11,000 volts without the use of step-up transformers.—*St. R'y Jour.*, August 29.

The Electric Motor as Railroad Motor.—NIETHAMMER.—A short review of recent practice.—*Zeit. f. Elek.*, August 16.

Overhead Construction for Traction Work.—WELTER.—An illustrated description of the overhead arrangement adopted by the Traction Company at Hagen, Germany. The profile adopted for the wire has a broad, flat shape. Protective measures taken against contact with telephone wires are described, as is also a complicated construction at a railroad crossing.—*Elek. Zeit.*, August 13.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Possible Economies in Central Station and Distributing Systems.—DAWSON.—An article considering the general trend of modern practice in Europe and America. The author (who is an Englishman) points out that there are two directions in which improvements can be made in the future, one in the existing machinery and in the addition of labor-saving appliances; the other, in radical changes in the system, as for instance in the use of steam turbines, gas engines or possibly gas turbines, in place of reciprocating engines. Most of the labor-saving appliances in common use have originated in the United States; among them are coal and ash-handling apparatus, which is now considered a necessary adjunct of any large station. Mechanical stokers are also generally used. In Great Britain the moving chain stoker is the most popular. Continental practice inclines toward hand stoking on account of the cheapness of labor.

The boilers show no great change from former practice. In Great Britain the water-tube boiler is very popular and at present about 30 per cent. of the stations use a horizontal boiler of this type. In the United States this boiler is also used widely, but vertical water-tube boilers are also employed. On the continent boiler practice differs radically from that in the two other countries mentioned. and two-story boilers are usually employed. Mechanical draft is popular in America, although by no means universal; the author believes that its use is spreading in England. British and American practice lean strongly toward vertical engines; the standard engine for both countries is a vertical cross-compound, while in Germany the horizontal engine is more popular. American and British engines are simpler in construction and the Corliss valve is largely employed, while on the continent the poppet valve is more generally used, largely because superheated steam is employed to a greater extent, and the German and Swiss engines are characterized by more complicated and intricate valve gear than in Great Britain and America. The relative advantages of superheated steam and the researches made with lubricants and packing which will stand the higher temperatures of superheated steam, are then discussed, and some tests with superheated steam are given. Steam turbines are coming into use; their advantages over reciprocating engines are given. Cooling towers are more usual abroad than here. In continental practice auxiliaries like pumps and exciters are more generally directly connected to the main engines, but the author prefers the American practice of independent auxiliaries as a rule. On the continent storage batteries are more general partly because triple-expansion engines are more generally used, and these do not give their best results under variable loads. Gas engines are more common on the continent than in Great Britain or America. The question of direct-current voltage is discussed. On the continent 750 volts are used, but it is questionable whether there is any material advantage gained thereby in view of the additional difficulties introduced in the design of railway motors. He refers briefly to polyphase traction; while it is used in Europe, the success has been due largely to local conditions, owing to the number of trains being small, the repairs are not an important item, and as water power is used, waste of energy is not felt. Engineers in Great Britain and the United States are looking forward, however, to the design of a practical alternating-current motor, especially a single-phase motor.—*St. R'y Jour.*, August 29.

High-Pressure Oil Switches.—BENISCHKE.—A paper read before the German Electrotechnical Society. The author has found that two conditions have to be fulfilled, when large currents are interrupted under oil; first, no air must be allowed to get to the interruption spark, and second, the oil must enter with a certain pressure between the contacts at the moment, when the current is interrupted, whereby

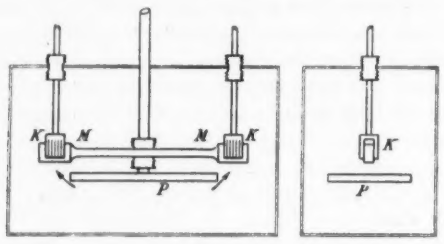


DIAGRAM OF OIL SWITCH.

the arc is suppressed at the moment it is generated. If these conditions are not considered, it may happen that such a large amount of oil is carbonized between the two contacts; that a conducting bridge is formed. The author fulfills these conditions in an apparatus constructed by him and illustrated diagrammatically in the adjoining figure. The leads are introduced through the lid of the case of the switch and are connected by the piece, *M*, when the switch is closed. The opening of the switch takes place by moving *M* downward, whereby the current is interrupted simultaneously at both contacts, *K*. A wooden plate, *P*, is connected to the piece, *M*, which, when the latter is pushed down, pushes the oil up towards the contacts, thus breaking the arc before it has reached a length of 2 to 3 mm. The carbonizing of the oil and the burning of the contacts is thereby reduced to a minimum. A description and illustration of a switch embodying this principle are given, together with an account of tests to which it has been subjected.—*Elek. Zeit.*, July 30.

Wimbledon, England, Electricity Works.—A well-illustrated description. Steam power is furnished by water-tube boilers, two of which are heated by four refuse destructors. The generating plant consists of five sets of alternators, 3 of 120 kw each and 2 of 350-kw capacity each. They furnish 2,250 volts at full load at 50 cycles. The engines are of the three-crank compound type, directly-coupled by flanged fly-wheel couplings. The transformers in the sub-stations vary from 10 to 50-kw capacity, and step the current down to 440 volts across the outer wires of a three-wire distribution system.—Lond. *Elec. Rev.*, August 14.

REFERENCE.

Construction of Connections and Switches.—EDLER.—A paper presented before the Electrotechnical Society of Vienna. The author gives a method for the calculation of switching devices, where a number of connections have to be made. This object is to do away with the usual method of laborious trial. He demonstrates the method by the calculation of a number of examples, some of them more or less intricate. Diagrams illustrating the connections are given.—*Zeit. f. Elek.*, August 2 and 9.

ELECTRO-PHYSICS AND MAGNETISM.

Atmospheric Electricity Considered from the Standpoint of the Theory of Electrons.—EBERT.—A paper read before the Swiss Society of Natural Sciences. From balloon experiments carried out by himself and others, the author deduces that the electronic charge, or the number of electrons, generally increases very rapidly with the altitude, so that a proportionally very high degree of electrical conductivity for the highest strata may be assumed, and indeed must be assumed if phenomena like the Aurora are to be explained. In the lower layers of the atmosphere there generally is found a preponderance of the positive charges, apparently due to the fact that the terrestrial globe is itself negatively charged and therefore attracts the positive electrons. For this reason there is a preponderating number of positive electrons present above mountain summits, where the density of the terrestrial charge assumes a particularly high value. When a balloon enters a new stratum of air, there is also observed a sudden change in the electronic charge and also in the proportion in which the positive and the negative charges are mixed in these strata. Therefore, just as each stratum is characterized by a certain temperature and moisture, so it is also characterized by certain electric properties, which seem to be conditioned chiefly by its origin. Of special importance is the fact that the aqueous vapor condenses more readily upon the negative than upon the positive electrons, and consequently that during progressive condensation the negative particles are precipitated first, followed by the positive. The charge of free electrons present in a layer of air in which condensation has just begun, must be of great importance in the formation of clouds in that stratum. The author also gives an explanation of the electric charges in the clouds and investigates the problem of the permanent charge of the earth and the existence above it of a field of electrical tension.—*Meteorologische Zeitschrift;* reprinted in *West. Elec.*, August 8.

Dielectric Cohesion of Gases at Different Temperatures.—BOUTY.—The author studied the variation of the dielectric cohesion of various gases with the temperature. He concludes from his measurements that the variation, if it exists, can certainly not surpass 1/100 between the ordinary temperature and 190° C. This result holds not only for air, hydrogen and carbonic acid, but also for gaseous mixtures such as those of hydrogen and carbonic acid or hydrogen and oxygen, for which the dielectric cohesion, measured at ordinary temperature, is very sensibly inferior to the mean of the dielectric cohesion of the mixed gases. The author thus arrives at the remarkable law that the dielectric cohesion of a gas or a mixture of gases, depends only upon the average distance of the molecules, as long as the molecule or the molecular groupings are not altered. At constant volume, the dielectric cohesion is independent of the temperature; at constant pressure it varies inversely to the absolute temperature.—*Comptes Rendues,* Tome 136, p. 1646; abstracted in *L'Eclairage Elec.*, August 8.

REFERENCE.

Röntgen Rays.—KUEPPERS.—An illustrated description of several recent apparatus and appliances in the X-ray practice for medical purposes.—*Elek. Anz.*, August 2.

ELECTRO-CHEMISTRY AND BATTERIES.

Iron and Steel Production in the Electric Furnace.—GOLDSCHMIDT.—A long, well-illustrated paper, read before the recent Congress of Chemistry in Berlin. The author reviews in detail the Stassano

process, repeatedly mentioned in the Digest. Calculations of the charge for this furnace and the methods of operation are given, and also a detailed statement of the cost of production. The furnaces of Héroult and Keller are described and illustrated. Héroult uses two arcs, each working with 4,000 amp. at 60 volts alternating current. The weight of each melt is about 3 tons and several charges are finished in one day. The Kjellin furnace is also illustrated and a detailed statement of the cost of melting a ton of steel is given. A very complete bibliography of the subject is given at the end of the article.—*Zeit. f. Electrochem.*, August 6.

Determination of Molecular Weight at Very High Temperatures.—NERNST.—A paper read by this well-known physical chemist before the recent Congress of Applied Chemistry in Berlin. He determines the molecular weight of substances by vaporizing them at about 2,000° C., in an iridium furnace, which receives about 2,000 to 3,000 watts from the thick wire winding of an oil transformer.—*Zeit. f. Electrochem.*, August 6. (This furnace is presumably the one illustrated and described by that author in his paper before the American Electrochemical Society and published in the *Transactions*, Vol. III, p. 75.)

UNITS, MEASUREMENTS AND INSTRUMENTS.

REFERENCE.

Radiating Rheostat.—SOULIER.—An illustrated description of a rheostat composed of a German silver wire, wound in the form of a spiral on an insulating frame, and dipped into a non-conducting liquid like oil. The vessel containing the oil is constructed of a corrugated iron casting, in order to obtain a larger radiating surface. —*L'Industrie Elec.*, August 10.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telegraphy by Electric Rays.—BLOCHMANN.—A popular, illustrated description of the author's system of telegraphy by the electric rays. He uses lenses formed of a substance with a high dielectric constant, such as rosin, glass or paraffine. The generating and receiving apparatus are enclosed in metallic casings, in the front of which such a lens is arranged, so that the electric rays have to pass through them. The lenses concentrate and direct them. The author states that he has succeeded in sending telegrams over a distance of over 1 km., with lenses 80 cm. in diameter and waves of 20 cm. length, which required less than one kw.—*Rev. Gen. des Sciences*, August 15.

REFERENCE.

Electric Signalling.—WALSSOE.—An abstract with diagrams, of a description of the author's signal system, to transmit the positions of the mechanical line signals to the office of the station master for control purposes.—*Elek. Zeit.*, August 14.

New Books.

PUBLIC LIGHTING BY GAS AND ELECTRICITY. By W. T. Dibdin, F. I. C., F. C. S. New York: D. Van Nostrand Company. 537 pages, 216 illustrations. Price, $8.00.

A vast mass of information is included within the covers of this portly volume. Not all of this information is of the same value, or, rather, no one reader is liable to find all parts of this book of equal value to him. Mr. Dibdin's strongest suit is evidently practical photometry, and in this department he gives complete details of all the photometers now in use, together with much information concerning the effective use of each kind of photometer.

His discussion upon the different forms of gas burners, with their relative advantages and drawbacks, is also interesting and suggestive, especially as he often points out what is too frequently forgotten, namely, that each kind of burner is best adapted to one single set of conditions and that it does not at all follow that a burner which is economical in one case will be so in others. Accompanying, and often mixed in with, the practical part of the work is a great deal of discursive information on the English gas situation, including, however, many valuable tables and excerpts from official reports.

The portion of this work which deals with electricity does not seem to be either so authoritative or so valuable as that which deals with gas lighting. Some seventy pages are given up to a description of dynamos, motors, transformers and circuits, which is quite elementary, not to say amateurish, in its character, and these chapters might either have been altogether omitted or condensed into an introductory note of two or three pages. When the author comes to consider the economical efficiency of different kinds of electric light he reaches much firmer ground, though even here he conveys the impression that in practical theory as well as in broad grasp of the engineering principals which underlie the dispersion of power in the form of light, the English standards in electric lighting are considerably behind those of the larger central stations in the United States. As presenting, however, a view of English central station engineering, the work is of interest, and much instruction will be found in the sections above referred to treating of practical photometry and the efficiency of the electric light.

A TREATISE ON ELECTROMAGNETIC PHENOMENA. The Compass and Its Deviations Aboard Ship. Vol. II. By Commander T. A. Lyons, U. S. N. New York: John Wiley & Sons. 580 pages, 203 illustrations. Price, $6.00.

The first volume of this work, which was reviewed in these columns, was occupied by the subject of "Electromagnetic Phenomena," which was designated as "Part I." The present volume contains five more parts, all of which pertain to the compass. This arrangement agrees with the title, but it seems to be an unique plan in book writing. The author justifies this plan on the ground that "all the matters dealt with affect the compass either proximately or remotely." In other words, the general information contained in the first volume is intended as a preparatory course of study, so as to enable the reader to understand the second volume, which treats specifically of the compass.

The author has certainly collected a large amount of information about the compass, and made a volume of pleasing appearance. His treatment of the subject is somewhat diffuse, but he justifies this, more particularly in connection with mathematical formulas, by the statement that "although the skilled mathematician may prefer the curtailed treatment, still it is thought that many others would rather have the easy transition than elegant brevity." One peculiarity of the author's style is the lavish use of capitals, reminding one of the "Fables of Aesop," and a correspondingly frequent use of italics.

The volume opens with an "Historical Sketch" of the compass, in which the author very pertinently says that every country, ancient and mediæval, has laid claim to the invention of the compass, and furthermore, that various writers have undertaken to sift the evidence, but with a result usually tinged with the bias of the writer. The construction of the ship's compass as used in the United States Navy is next considered, both as to actual construction and mechanical and magnetic principles involved.

"Part Third" treats of "The Ship a Magnet," "Part Fourth" of "The Mathematical Theory of the Deflections," "Part Fifth" of "Swinging Ship and Compensation of the Deviations," and "Part Sixth" of "Various Matters bearing on the Main Subject." It will be seen from this that the compass is very thoroughly discussed in all its relations. In fact, the book gives evidence of wide and somewhat careful reading, and, on the whole, good judgment in compiling; in some cases, however, the author's treatment of a subject is disappointing and does not come up to what one would expect from the writer of such an ambitious work. For example, the remarks on potential, in Part Sixth, which are accompanied with abundant references to standard works, lead one to expect an eclectic definition of potential formulated by taking the best from each of the classic writers; but the definition given is "The word potential indicates generally the condition to which it is applied—the power to do work"—which, although it may be true, conveys a minimum of information. After giving the equation of Laplace in its usual symmetrical form, the author says "This expresses mathematically the fact that the function V changes by the smallest amounts possible in the directions of the co-ordinate axes; it is, therefore, exactly applicable to the potential condition." The reviewer is not certain that he understands just what this means, but it certainly is not a lucid exposition of the meaning of the equation of Laplace. The equation of Laplace is an analytical statement of the fact that the sum of all the inward fluxes through a given closed surface is equal to the sum of all the outward fluxes through the same surface at the same time. That is, that the total flux, algebraically reckoned, is zero. This is equivalent to the statement that central forces and other physical quantities which have a potential, act like incompressible fluids. Further on the book states that to apply the equation of Laplace practically, its development into a series must be employed. This statement is entirely too broad. There are many cases where

we have the solution of this equation in algebraic terms of finite number.

ELEKTRO-METALLURGIE DES NICKELS. Von Dr. W. Borchers. Halle: Wilhelm Knapp. 36 pages, 4 illustrations. Price, 1.50 marks.

This book is not at all up to the standard set by previous books in this series, and is open to serious criticism in several particulars. It is manifest that the author has inflicted his own "ego" obtrusively on every one of the thirty-five pages of the pamphlet. Practical achievements of Americans are neglected while "paper" processes of foreigners are given undue prominence. In America, for example, there have been two electrolytic nickel processes that have each produced several hundred thousand pounds of "electro-nickel," assaying Ni 99.50 per cent. or better, which metal has been sold for commercial purposes. The reviewer refers to the process of the Canadian Copper Company, developed by Mr. David H. Browne, and that of the Balbach Smelting & Refining Company, developed by Messrs. F. A. and Wm. Thum. A careful perusal of the book finds no mention of these processes, and the index shows neither the name Browne nor Thum. The process of a certain Herr Guenther, who had the advantage of studying at Aachen, receives much attention, to the exclusion of the work of the above-mentioned electro-metallurgists, who have demonstrated processes to their credit. However, the book contains some information of a theoretical nature and might be of use to him who knows how to read "cum grano, NaCl."

ELECTRICAL PROBLEMS. By Prof. William L. Hooper. Boston: Ginn & Company. 170 pages, illustrated. Price, $1.25.

This is intended for a text-book for electrical classes in colleges, and the problems contained are well chosen from the different branches of electricity. Beginning with the simpler applications of Ohm's law as usual, they proceed to inductance of coils, capacity of condensers, thermo-electricity, electro-chemistry, efficiency of batteries, generators, motors, etc. Then alternating currents are taken up, the problems including cases of constant and varying values of resistance, inductance capacity and frequency. The next set of problems relates to calculating winding tables and making drawings for direct and alternating-current armatures, and to armature reactions, field windings, etc. The last set of problems relates to the winding and operation of transformers, rotary converters and induction motors, and to the testing of dynamos and the transmission of power.

There is a wire table for "B. S. G." sizes, evidently meaning B. & S. G., giving the diameters in mils and millimetres, areas in circular mils and square millimetres, weight in pounds per 1,000 ft. and kilograms per kilometre, resistance per 1,000 ft. and per kilometre at 0, 20, 40 and 60° C. It is not stated on what data this table is calculated, but probably, so far at least as specific gravity is concerned, the data are substantially the same as for the much-quoted table of the American Institute of Electrical Engineers, for although most of the weights given do not agree in the two tables, the difference is as likely to be one way as the other. The resistances are in nearly the same category, some being lower in this table and some in the Institute table. The differences appear to be chiefly due to errors in the calculations, for, as already stated, they are pretty evenly balanced between positive and negative. These errors in all probability exist in both tables.

DAS ELEKTRISCHE KABEL. By Dr. Phil C. Baur. Berlin: Julius Springer. 327 pages, 72 illustrations. Price, 8 marks.

This is a book upon electric cables. It is limited to a description of the materials used and methods employed in insulating underground circuits. The first portion deals particularly with insulating materials, describing their characteristics both electrically and mechanically and giving considerable valuable technical data, particularly as to insulation resistance. The next division deals with telephone cables and is probably one of the most complete exponents on this subject in print. The matter is fresh and embraces the most recent German experiments upon the Pupin system of balancing inductances. Then comes considerable descriptive matter relating particularly to the manufacture of cables of all kinds, especially those intended for alternating currents.

An exceedingly interesting feature is a number of specifications giving dimensions of conductors, insulating material, armor and sheathing. The last third of the volume is devoted to a description of conduit work, as it is found in Europe, while finally a very fully illustrated account of cable manufacturing machinery is appended, many of the illustrations appearing to be taken from working drawings. Excepting in the earlier pages of the work, little mathematics are encountered. It is descriptive and written from the standpoint of the central station manager, as well as that of the manufacturer.

ELECTRIC AND MAGNETIC CIRCUITS. By Ellis H. Crapper, M. I. E. E. New York: Longmans, Green & Co. 379 pages, 62 illustrations.

This text-book, which is the best elementary treatise on the subject the reviewer has yet seen, is a notable exception to the usual treatises on electricity and magnetism in that it takes up each subject from the practical point of view, giving worked numerical examples as well as numerous exercises for practice, nearly 700 of the latter being contained in the book.

In order to give an adequate idea of the aim and scope of the book we cannot do better than to quote from the preface: "Twenty years ago Lord Kelvin made the following statement at a meeting of the Institution of Civil Engineers: 'In physical science a first essential step in the direction of learning any subject is to find principles of numerical reckoning, and methods for practically measuring some quality connected with it. I often say that when you can measure what you are speaking about, and explain it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind.' As many otherwise useful and excellent text-books on electrical engineering give very little or no opportunity for the student to obtain this essential acquaintance with the quantitative side of the subject, there appears to be a real demand for a book that does supply this want, and this the author claims for the present volume. The plan adopted in this book to meet this demand has been to deduce the fundamental principles of electrical engineering from the system of practical electrical units, now universally used as a basis, and to deal with the various elements of the subject in the same order that the engineer meets with them in practical everyday work. An earnest endeavor has been made to introduce nothing but the simplest mathematics."

The subject is divided into eleven chapters, as follows: (1) Practical Electrical Units (with exercises on electric currents, resistance, Ohm's law, work and power). (2) Electric Circuits and Electrical Effects (with exercises on series circuits, shunts, insulation resistance, condensers, arrangement of cells, heating effects, and chemical effects). (3) Principles of Distribution and Design of Mains (with exercises on house wiring, Kelvin's law, electric light and power circuits, and 3-wire system). (4) Magnetism (with exercises on magnetism, magnetic fields, magnetic moments, torsion balance, oscillation of a magnet, and intensity of earth's magnetism). (5) The Magnetic Circuit (with exercises on magnetizing coils, reluctance, permeability, ampere-turns, pole strength, intensity of magnetization, and magnetic circuit of dynamos). (6) Coil-Winding Design (with exercises on coil winding-problems, field winding of dynamos, and tractive force of magnets). (7) The Generation of Electrical Pressures (with exercises on generation of e.m.f. in armature, drag on armature conductors, etc). (8) Types of Dynamos (with exercises on efficiency calculation of series, shunt, and compound-wound dynamos). (9) The Electric Motor (with exercises in electric motor and electric traction problems). (10) Efficiencies and Dynamo Calculations (with exercises on output, speed, and efficiency of electric motors). (11) Systems of Electrical Units (with exercises on the conversion of the different systems of units, etc). In an appendix, a number of tables of physical constants, wire gauges, logarithms, etc., are given to aid in solving the numerical examples, and a key to the exercises is attached.

The present book forms an introductory volume of a complete treatise on Electrical Engineering, and deals with continuous-current circuits only. Whilst a considerable portion is devoted to the practical application of electricity, it is not intended to be a text-book on the design of distributing mains or continuous-current machinery, but to indicate how the fundamental principles may be applied to the many and varied problems encountered in practical work. The subject of alternating and polyphase-current circuits is not taken up, as this branch of electrical engineering is to receive special treatment in a second volume now in preparation.

The book is clearly written and will be found of great help not

only to beginners, but also to more advanced students of electrical engineering.

Mr. C. P. Steinmetz's work, "Alternating Current Phenomena" has been translated in French by Henri Mouzet, and issued by Vve Dunod, at 21.50 francs. The same work has also been translated into German.

BOOKS RECEIVED.

DIE STRASSENBAHNEN IN DEN VEREINIGTEN STAATEN VON AMERIKA. By Gustav Schimpff. Berlin: Verlag von Julius Springer. 190 pages, 224 illustrations. Price, 6 marks.

GRUNDRISS DER DEINEN UND ANGEWANDTEN ELEKTROCHEMIE. By P. Ferchland. Halle: William Knapp. 266 pages, 59 illustrations. Price, 5 marks.

GRUNDRISS DER REINEN UND ANGEMANDTEN ELEKTROCHEMIE. By P. Ferchland. Halle: Verlag von Wilhelm Knapp. 271 pages, 59 illustrations. Price, 5 marks.

ELECTRICAL ENGINEERING MEASURING INSTRUMENTS. By G. D. Aspinwall Parr. New York: D. Van Nostrand Company. 322 pages, 370 illustrations. Price, $3.50.

SECONDARY BATTERIES. A Practical Handbook for Owners and Attendants. By an Engineer. London: H. Alabaster, Gatehouse & Company. 77 pages, illustrated. Price, 4 shillings.

ELEMENTARE VOILESUNGEN UBER TELEGRAPHIE UND TELEPHONIE. Von Dr. Richard Heilbrum. Berlin: Georg Riemens. 164 pages, 45 illustrations.

DIE KERSTELLUNG DER AKUMULATOREN. Ein Leitfaden. Von F. Grunwald. Halle: Wilhelm Knapp. 158 pages, 91 illustrations. Price, 3 marks.

ELECTRIC AND MAGNETIC CIRCUITS. By Ellis H. Crapper, M. I. E. E. New York: Longmans, Green & Co. 379 pages, 62 illustrations.

DISTRIBUTION DE L'ENERGIE PAR COURANTS POLYPHASES. Par J. Rodet. 2 ieme Edition. Paris: Gauthier-Villars. 562 pages, 213 illustrations.

DIE ELEKTROCHEMIE. Industrie und Gewerbe-Ausstellung in Dusseldorf, 1902. Von H. Danneel. Halle: Wilhelm Knapp. 84 pages, 66 illustrations. Price, 6 marks.

KONIGLICHEN TECHNISCHEN HOCHSCHULE ZU AACHEN. Von Dr. Wilhelm Borchers. Halle: Wilhelm Knapp. 62 pages, 89 illustrations. Price, 6 marks.

Tests of the Edison Storage Battery.

From a report recently made by Mr. W. Hibbert on tests in England of the Edison storage battery, we extract the following details, and reproduce several sets of curves based on the data of the tests.

The standard automobile cell is of rectangular shape. It stands 13 in. high (over all), measures 5.1 x 3.5 in. horizontally, and weighs 17.8 pounds. It contains 14 positive and 14 negative plates. Each plate is made of sheet steel, nickel-plated, punched with 18 rectangular holes. In each of these holes is inserted a flat pouch or pocket containing the active material. The walls of these pockets are perforated by exceedingly fine, short slots, through which the liquid can penetrate. Thus the current can easily pass to and from the active material contained in the pocket.

Both positive and negative plates are alike, except in respect of the active material. The pockets in the negative plate contain finely-divided iron; those in the positive contain peroxide of nickel. The liquid is a 20-per-cent. solution of potash. This suffers no change during the action of the cell, except the loss of a small quantity of water, which is decomposed whilst the cell is being charged. A small quantity of electrolyte suffices as it acts merely as an electrolytic conductor and not as an active material in the ordinary sense. The plates may, therefore, be fixed very near each other, for the narrow intervening space allows an adequate supply of potash solution.

The proximity of the plates does not apparently involve danger of short-circuiting. The plates are thin, but being made of steel their rigidity is exceptionally good. Mechanical stability is further assured by vulcanized rubbed separators, the whole forming a compact mass, calculated to resist all the ordinary mechanical shocks it is likely to undergo.

The only special mechanical difficulty which seemed probable was the chance that the gases evolved during a "charge" might eject some of the active material from the pockets. During the test, therefore, the pockets were watched carefully, especially during very heavy charges, but without any evidence of loss.

The cell is sealed in its steel case. Two stout connecting pins (from the positive and negative plates respectively) come through liquid-tight bushings of vulcanized rubber. These pins are made slightly conical, as are also the connectors which fit on them, and

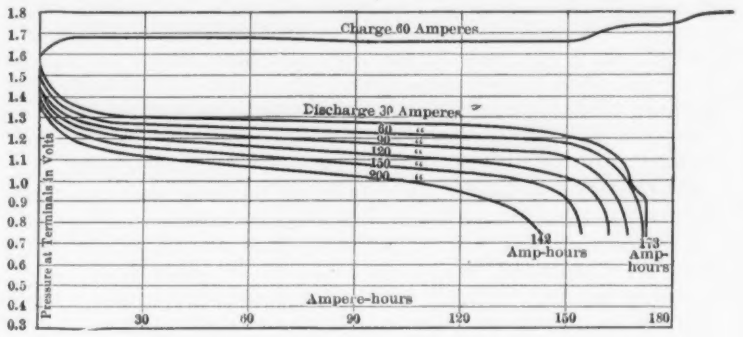


FIG. 1.—CURVES OF DISCHARGE VOLTAGE.

the mechanical finish and easy grip of this terminal add to the value of the battery. On the top of the case there are also a spring stopper with rubber flange, covering the hole by which the electrolyte is introduced, or distilled water added from time to time; and a vent hole guarded by a gravity valve. This latter provides for the escape of the gas evolved during charge. The hole and valve are covered by a gauze nipple, which prevents escape of spray while allowing gas to pass. Acting on the principle of Sir Humphrey Davy's safety lamp, the same gauze further prevents any chance of explosion should a flame be brought near to the exit.

The e.m.f. is 1.33 volts. The internal resistance is 0.0013 ohm. The output at 60 amp. is 210 watt-hours, or at the rate of 11.8 watt-hours per pound of cell. The discharging value at high rates of discharge rises to many times the normal. The cell suffers no appreciable polarization, and therefore recovers its normal voltage almost instantaneously when the current returns to an ordinary value.

In the accompanying curves, Fig. 1 shows the pressure during discharge. Each line corresponds to a constant current, the discharge rates varying from 30 to 200 amp. This last is a high rate for a cell of this size, but the experiment proved that the cell could stand it without injury. It took the succeeding charge in an excellent way, and yielded the 30-amp. curve immediately afterwards. At 120 amp. the output was 91 per cent. of the maximum. Even

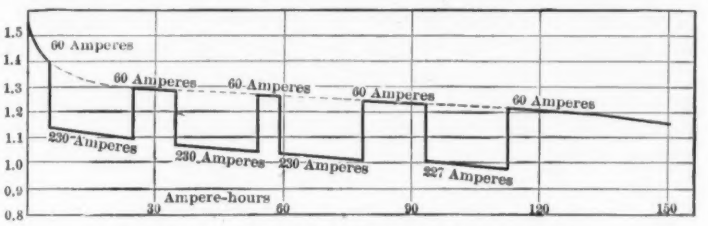


FIG. 2.—CURVE INDICATING FLEXIBILITY OF CELL.

at 200 amp., the quantity (ampere-hours) is 82 per cent. of the maximum.

In Fig. 2 are given the results of one out of many experiments, intended to test the flexibility of the cell. The standard cell was discharged, starting at 60 amp. After a time (5 minutes) the current was suddenly increased to 230 amp. A little later the current was reduced again to 60, and so on, as shown by the curve. The cell yielded this great current for short intervals and recovered almost instantaneously. It does not appear to be injured in any way, and subsequent charging and discharging seemed to be quite normal.

An important point in traction cells is the rate at which they can be charged. Experiments on this point demonstrated that the Edison cell will absorb 70 to 75 per cent. of its full charge in one

hour. Fig. 3 shows the result of one of these experiments. The cell charged for one hour only, at the excess rate of 175 amp. It was then discharged and gave data for the curve. This shows that it absorbed and could deliver 124 amp.-hours out of the 175 put into it at this very great rate.

After three months' work with very many charges and discharges

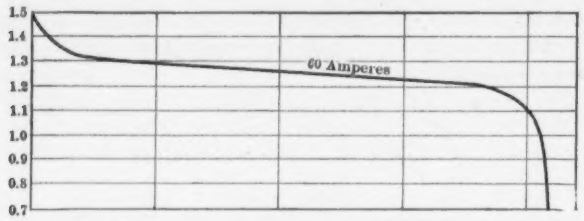


FIG. 3.—TEST CURVE OF A TRACTION CELL.

the capacity of the cells remains the same as at the beginning. It has neither increased nor diminished. Examination of the plates after three months' work does not indicate any signs of corrosion. The plates are as even in surface and as rigid in strength as at the beginning.

The standard cell was sent to England from America via Paris, and therefore underwent two transshipments, together with many loadings and unloadings, and journeys by rail and road. This long and varied journey was made in its ordinary working conditions, the plates and fittings in the case fixed as in use. The only difference was one that the cell traveled without the liquid, so that the plates were more or less exposed to air.

On its arrival, having in it no liquid except that which had trickled off the plates to the bottom, it was joined to a voltmeter and gave 1.33 volts. The full quantity of electrolyte was then put in and the cell given a first charge and discharge. The output following this first charge was 174 amp.-hours, a figure identical with that obtained after further treatments.

Power Plant in the Patton Paint Company, Newark, N. J.

The new works of the Patton Paint Company, recently erected at Newark, N. J., is one of the most modern paint factories ever built. It consists of a five-story building with a tower—the paint factory proper—a low building to accommodate the shipping and storage departments, and a building for the power plant.

In the power house the boiler room is separated from the engine room by a fire-wall and contains two Coatesville return tubular boilers, each of between 175 and 200 boiler-horse-power. The gases of combustion are conveyed to a chimney 80 ft. high and 4 ft. in diameter on the inside. From the boilers an 8-in. steam main leads through the dividing wall into the engine room and connects to a 12 and 24 x 36-in. Hewes & Phillips horizontal cross-compound condensing Corliss engine, which runs at 125 revolutions per minute and drives by direct-connection a 125-kw, 250-volt Crocker-Wheeler direct-current generator. Floor space and arrangements for future piping connections have been left to allow for the installing of another engine-generator unit of the same apparatus and size. In the meantime it is so provided that if the load exceeds the capacity which the engine has when running in its normal manner, the high-pressure cylinder may be caused to exhaust to the atmosphere and the low-pressure cylinder may be supplied directly with live steam reduced to at least 80 pounds for the sake of safety, or still lower, depending upon the amount of the overload. The compound engine may thus be resolved into two simple engines. This is perfectly allowable as the generator is abundantly capable of carrying a much greater overload than the engine under regular conditions of operation it is designed for.

The electric current is generated at 250 volts and supplies an average load of 475 amperes divided among eighteen motors, ranging in size from 1 to 35 hp and aggregating 366 hp; 17 arc lights and 200 incandescent lamps. After working hours the engine is stopped and the incandescent lighting is thrown on to the city alternating-current service for the night.

The switchboard is very clearly shown in one of the accompanying cuts. At present it consists of three panels with the usual instruments, switches, etc., and which from left to right are identified as generator, station and distributing panels, respectively. Eventually when the second engine is installed the board will be extended by the addition at the ends of duplicate generator and distributing panels.

In the main factory building wherever line shafting is used it is driven through a Renold silent chain by a Crocker-Wheeler motor

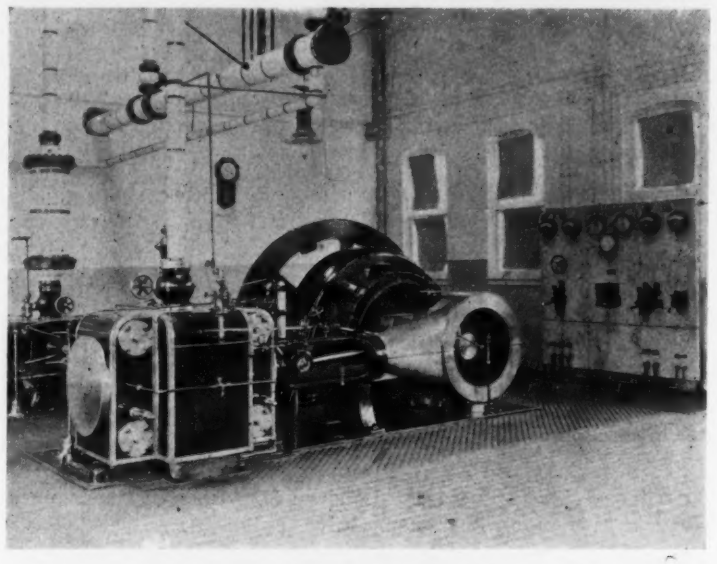


FIG. 1.—VIEW OF ENGINE ROOM.

on the floor above. On the fifth floor there are two motors, one of 35 and one of 15 hp, each of which drives a lead chaser. These are pieces of apparatus in which white lead, the foundation for all of a certain class of paints, is worked and freed of its contained moisture. On the fourth floor there are two 35-hp and one 20-hp motors, driving shafting on the floor below. An accompanying cut shows one of the two larger motors and the manner in which they are housed to protect them from the powdered white lead and dust which is very apt to be floating in the air. The third floor has a pair of similar 35-hp motors and one 10-hp motor all driving through the floor with chain connections. These motors are not enclosed, but sheet-iron casings cover the chains and sprocket. Another cut shows the two 35-hp

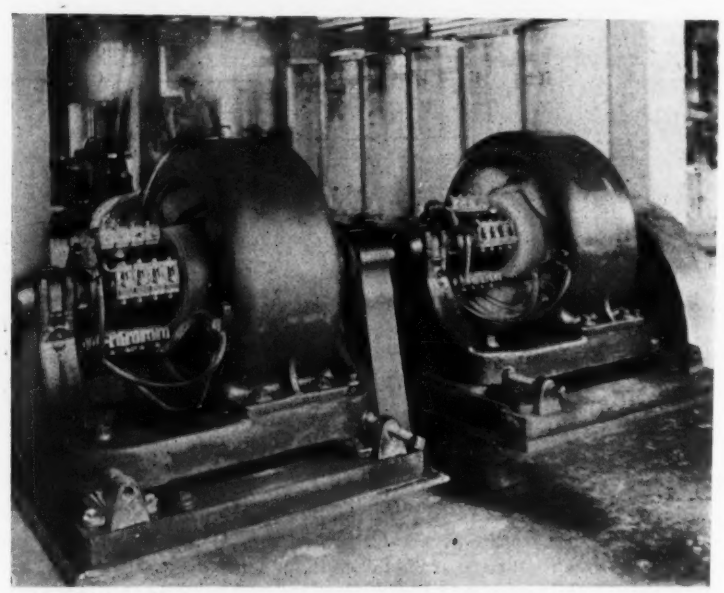


FIG. 2.—TWO 35-HP MOTORS.

motors at close range with one of the casings removed, exposing the chain. It is interesting to add that, at the time the picture was taken the motors were running at 800 revolutions per minute and, although a time exposure was made, the rotating parts are the only ones that are blurred, indicating how very slight was the vibration. On the second floor there are two 10-hp motors, driving paint mixers on the first floor, and three 15-hp semi-enclosed Crocker-Wheeler motors direct-connected to so-called "Giraffe" mills, in which the white lead receives its final grinding.

In the cellar there are four motors. One of 12 hp operates a slow-speed freight elevator which was installed by the Morse-Williams Company, of New York. At each floor the elevator shaft is provided with an automatic gate which rises and falls as the car passes that floor, being fully open only when the bottom of the car is exactly at the floor level. A 7-hp motor running at 1,100 revolutions drives a 7½ x 4-in. air compressor, giving it a capacity of 35 cu. ft. of air per minute. The compressed air is used to blow dust out of motor armatures, etc., and is drawn from a storage tank in which the pressure is maintained at a constant value by the action of the air on an automatic switch. A 20-hp motor is belted to a 2¾ x 3-in. duplex water-circulating pump, and a 3-hp motor is geared to a Deane Holyoke triplex oil pump. The latter is used in connection with an especially interesting system for handling the various kinds of oil used in the manufacture of paint. In the first place the oil is received at the plant in tank cars and is pumped therefrom to the one of the several storage tanks in which its kind is kept. The triplex pump is arranged with proper pipe connections and valves to make this selective distribution possible. For instance, if it is raw linseed

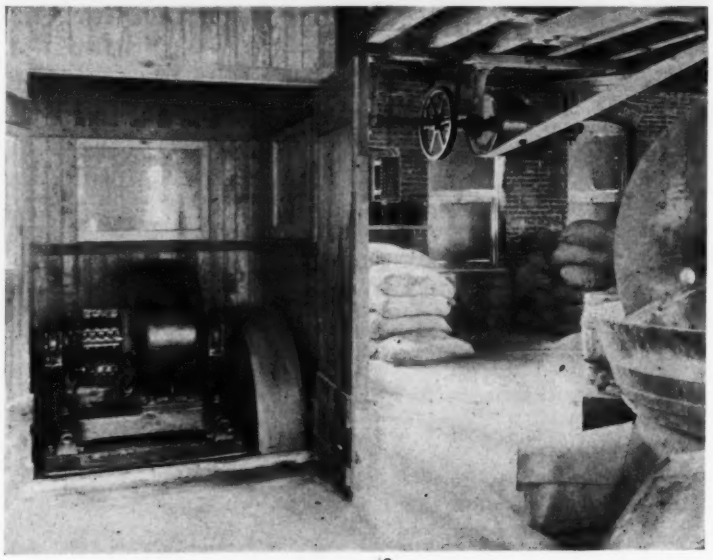


FIG. 3.—ONE OF THE "HOUSED" MOTORS.

oil that the car contains, it is passed to a certain 60,000-gallon tank in the yard, or if it is refined linseed oil it goes to another 60,000-gallon tank. Similarly, if it be turpentine it is delivered into one or the other of two tanks provided for those liquids.

Messrs. Hooper & Company, of Newark, N. J., were the architects for the building, and Mr. William R. Siegle, now chief engineer of the plant, superintended the installation of the mechanical and electrical features with the advice and consultation of Mr. Ludington Patton, secretary and treasurer of the company, and the late C. A. Funck, then superintendent. The Bailey Company, of Milwaukee, installed the heating system; the Crocker-Wheeler Company, the generators and all but a few of the smaller motors; and the Hewes & Phillips Iron Works, the engines and boilers.

New California Transmission Enterprise.

Several stockholders of the California Gas & Electric Corporation, including W. S. Tevis, are seriously considering the construction of an electric power transmission plant in Mono County, California. It is the intention to transmit power about 100 miles to mining districts in Nevada, including Tonopah. Some of the capitalists are interested in the mining country around Bodie and Lundy and it is possible that power will be supplied first at those points, unless mining should become more active in Tonopah. Two forces of engineers have been in the field for two months, and T. E. Theberath, who has been in charge of the California Gas & Electric Corporation's construction work at the new Nimshew power house, has been detailed for the electrical engineering work on this new project. The company has three new 2,500-kw, three-phase generators ready for shipment, which could be used for the Tonopah transmission. The plant and pole line can be constructed within four months if it is decided to push the work. Leevining Creek is one of the proposed sources of water power, a 1,600-ft. head being available. The Owens River Power Company, which also contemplates the construction of a 90-mile transmission line to Tonopah, has called a meeting of its shareholders for October 12 for the purpose of voting $2,000,000 in bonds, to secure funds. This company can develop 9,000 hp with a 400-ft. head of water by building four and one-half miles of flume. The location of the plant will be only 4,500 ft. above the sea level.

Cleveland Telephone Police Signal System.

In our issue of last week we referred to the contract recently awarded for the City of Cleveland, Ohio, for a complete new police signal equipment. The award of this contract closed a long contest, the main questions in consideration between the various systems proposed having been as to the relative value of a system based upon a telephone instrument with the other necessary signalling equipment, as compared with a system based on a telegraph instrument with its auxiliary appliances.

Previous to the development of independent telephony practically all police system equipments employed telegraph apparatus with circuit line construction for reporting and signalling to the central office from the various stations or patrol boxes, these circuit telegraph signal systems having had practically the monopoly in police department equipment. At the beginning of Mayor Johnson's administration the entire matter of a signal system for Cleveland was advertised, calling for bids under specifications allowing free and open competition. Bids were received under the last specifications nearly a year ago. All known makes of apparatus and systems were thoroughly investigated by special committees and experts, as well as by Mayor Johnson and other city officials personally. The three years' investigation resulted in the adoption of an equipment radically different from the old line telegraph system, and the contract has just been closed for a complete equipment of the police signalling and telephone system, put on the market by the Municipal Signal Company, of Chicago, and manufactured exclusively for them under the Cregier patents by the International Telephone Manufacturing Company.

The contract comprises nine combined operating desks, call indicating and connecting switchboards complete with power boards, power plants, and all other necessary central office apparatus pertaining to the electrical equipment, together with 200 weather-proof street patrol boxes, in all amounting to nearly $30,000.

In the face of each board is placed a map of the district for which it is intended in which is mounted line lamp signals for each patrol box, showing the exact location of the box. The map also shows the fire boxes and engine houses and the principal buildings or important points in the district. The board is also provided with special indicators for an emergency or wagon call signal, together with keys for conveniently cutting in the operator's set or ringing generator, with regular line lamp signals, answering jacks, proper answering, ringing and connecting appliances, and also a complete operator's telephone set in duplicate.

The patrol boxes contain a complete telephone equipment for giving a regular reporting signal to the office; also a distinct emergency or wagon call signal, a bell for an answer back signal, a heavy compound ringer with large gong for a patrolman's recall signal, cut-out switch, and proper protectors, all mounted in a heavy iron weather-proof protection box.

The system is arranged for giving two separate and distinct signals from the patrol box to the central office; two separate and distinct signals from the central office to the patrol box, as well as complete telephone equipment for oral communication between any of the boxes or any points of the system. It is a full central energy system requiring no local batteries or parts subject to deterioration at the box. Each patrol box is connected directly with the central office, avoiding all possible chance of mistakes in signalling or reporting.

This system was originally invented and patented as early as 1891 and a full district installed when extending the Chicago system in 1899. The entire city of St. Paul was equipped with the service several years ago, and it was adopted by Col. Berne, of the Pan-American Exposition for its police department used during the Fair.

Electric Hoists for Hamburg American Docks.

The most extensive installation of electric hoists for use on docks in this or any country is to be made at the new Hamburg-American docks at Hoboken, N. J. There will be 24 hoists operated by motors having an aggregate capacity of no less than 1,200 hp. The equipment will be used for loading and discharging all kinds of freight.

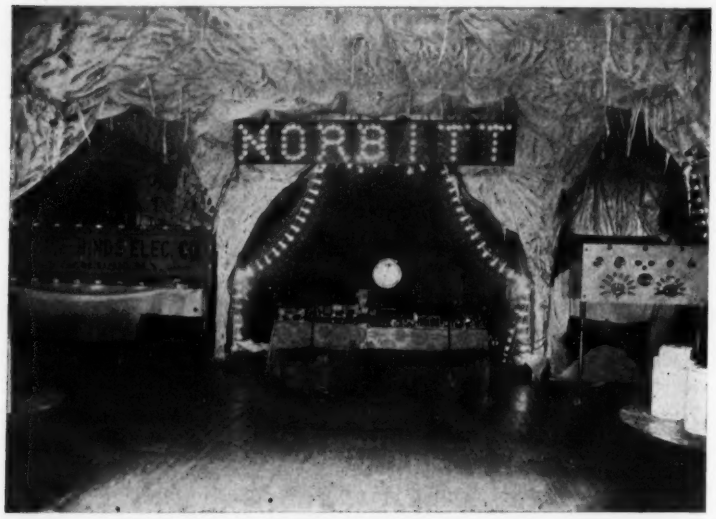
The hoists will be of two drum type direct-connected to motors of 50-hp capacity each. Each machine will be capable of handling 8,000 pounds, i.e., 4,000 pounds on each drum. Each drum will be independently operated and controlled by Cutler-Hammer 50-500-volt controllers. The circuit breakers, switch and field discharge resistance will be on the fire wall. On each side of the motor and within reach of the operator a push button will be placed which, in case of an emergency, he can press, and thus open the circuit breaker. The wires for the motors will be laid on steel conduit, which will run under the pier, the wires coming up at each machine. No overhead wires at all will be used. Power will be supplied by the United Electric Light Company of New Jersey. The cost of operating one of the equipments for 10 hours at present rates (5 cents per kilowatt hour) has been found to be $1.75.

The hoists have been designed by Mortimer Norden, of the Norden-Bittner Electric Company, New York. Six are now being built by the Consolidated Iron Works, Hoboken. The same number of motors will be manufactured by the C. & C. Electric Company, New York.

The Norden-Bittner Electric Company has the contract for the hoisting installation and also for lighting of the docks which will be done with 300 arc and 1,500 16-cp incandescent lamps.

"Norbitt" Exhibit at Atlantic City.

The most extensive exhibit made at the Atlantic City Convention of the Municipal Electricians was that of the Crouse-Hinds Electric Company, of Syracuse, N. Y., a view of which is given herewith. This consisted in a showing of the well-known "Norbitt" specialties in the "Grotto" of Hotel Rudolf. The display brought out the hand-



"NORBITT" EXHIBIT.

some decorating effects possible with "Norbitt" sockets, receptacles and moulding. For the decoration of the Convention Hall the same specialties were furnished gratuitously by the Crouse-Hinds Company, which made a very pleasing appearance, much commented upon by the delegates. The entire exhibit was under the personal supervision of Mr. F. M. Hawkins, of the New York office.

Kellogg Telephone Contract.

The Kellogg Switchboard & Supply Company, of Chicago, has been awarded the contract for a switchboard and telephones for Linton, Ind. The contract calls for an 800-line switchboard with ultimate capacity of 3,000, and telephones. The directors of the New Home Company, of Linton, compose part of the board of directors of the Knox County Telephone Company, of Vincennes, Ind. On account of the satisfactory results from Vincennes they ordered an exact duplicate of the board for Linton.

Exhibits at the Saratoga Convention.

Following is a continuation from our issue of last week of notices of exhibits at the Saratoga Convention:

GENERAL ELECTRIC COMPANY.—In place of making the usual elaborate exhibit of apparatus, the General Electric Company furnished one of the most striking and enjoyable features of the convention exercises by providing a trip to the Schenectady works for the delegates. As the great shops are only some forty minutes' ride from Saratoga, and are in themselves a tremendously impressive exhibit of the development of electrical industry, a better plan of entertaining and interesting the convention could not well be devised. A special train provided by the company, in charge of several of its officials, left Saratoga at 1 P. M. on Thursday, carrying about 700 people, including a great many ladies. This train was run on arrival directly into the General Electric yards, and the visitors were escorted to a new shop—No. 84—some 800 ft. in length, and of proportionate width, which it is proposed to devote entirely to the manufacture of the Curtis steam turbine. It seems to be the practice of the General Electric Company whenever a large party visits the works to put up a new building for its entertainment, the result being that the increase in the number of G. E. shops is remarkably rapid. After admiring this colossal building, the party proceeded upstairs to the gallery, which runs along one side, and at one end of which a sumptuous luncheon was provided for about 800 people. This function was presided over by Mr. J. R. Lovejoy, the head of the railway department of the company, assisted by several other of the leading officers, who happened to be in Schenectady, including Messrs. Rohrer, Potter, Hamill, Emmett, Haskins, and others equally well known. Owing to the magnitude of the gathering, and the speed with which lunch was served, there was little opportunity for speechifying, but Mr. Lovejoy made a pretty little speech of welcome on behalf of the company, which was responded to with equal felicity by Mr. Caryl Ely. After luncheon the party dispersed in squads to go through the shops, particular attention being paid to No. 20, where the steam turbine work is at present carried on. Thinking that many of the ladies might not care to visit the shops, a special trolley ride around the city was given on their behalf, the cars being tastefully draped with smilax. At a late hour in the afternoon, the special returned to Saratoga.

THE MAGNETIC EQUIPMENT COMPANY, of Chicago, the concern which has the device for increasing the traction of wheels on rails by means of magnetism, had a small model car equipped with the magnetic adhesion device. C. A. Ballard, treasurer; B. H. Honey, secretary; W. B. Frazier, chief engineer, and W. T. Davidson, general representative, were on hand explaining the apparatus.

THE STUART HOWLAND COMPANY had their exhibit in one of the parlors of the Grand Union Hotel, and made there a very elaborate display of the street railway overhead line materials, brackets, trolley catchers, swivel, trolley harps, and other well-known devices which they handle. H. W. Smith, from headquarters in Boston, and H. De Steese, from the New York office, were on deck.

THE NORBITT SPECIALTIES.—One of the most popular corners at the convention was situated in the hotel grounds just off the main piazza of the hotel. It is known as "The Pagoda" and is conducted as a restaurant by the Grand Union Hotel. It was here that the people attending the convention found their best opportunity to display that feeling of good-fellowship which is so characteristic of these gatherings. What made it especially attractive were the tasteful decorations, consisting mainly of incandescent lamps festooned all over the pagoda, the lamps being covered with red shades. This decoration was placed there especially for the convention, and was furnished by the Crouse-Hinds Electric Company, Syracuse, N. Y., who used the Norbitt temporary socket for the purpose. Everybody commented upon the beautiful appearance of "The Pagoda," and recognized the merit for decorating purposes of the Norbitt socket.

INSPECTING THE SCHENECTADY SYSTEM.—Upon the invitation of Mr. E. F. Peck, general manager of the Schenectady Railway Company, a number of those who took part in the General Electric trip to Schenectady, made a flying tour over the local trolley system in a private car provided for the purpose. This party included Messrs. H. N. Vreeland, Caryl Ely, W. J. Clark, J. G. White, J. H. McGraw, John I. Beggs, and many others—some twenty-five in all. A run was made first over the Troy division, and the car then came back and made another run over the line which runs almost as the crow flies direct from Schenectady to Albany. Not only did this trip give an opportunity to take a glance at the car barns and other

plants of the company, but every opportunity was afforded to inspect the magnificent work that has been done in roadbed and line construction. It may, in fact, be questioned whether there is a better equipped system in the country, or one which is handled with greater ingenuity and progressiveness, the result being that the receipts of the company have been increasing with leaps and bounds. Refreshments were provided on the special car, and at the close of the trip Mr. Peck was most heartily and deservedly thanked by all who had enjoyed the Schenectady Company's hospitality.

THE GOULD STORAGE BATTERY COMPANY had a neat booth on the lawn, which was devoted to an exhibit of their cell for railway and other purposes, together with detailed parts showing the construction of the plates employed in the different types. There were also sundry views around it of well known installations. And, among others, Messrs. Donaldson, Oakman and Draffen were on hand to receive and entertain the numerous callers at the space.

THE STANDARD PAINT COMPANY had a handsome booth out on the lawn in charge of Messrs. C. Earnshaw, F. F. Van de Water, and N. D. King. An interesting exhibit was made of the well known P. & B. productions, including electrical compounds, ruberoid tape and cloth, armature and field varnish, insulating tape, etc. Particular stress was laid upon the new feature of car wiring, lately introduced by the company, giving particular attention to the insulation and protection of motor leads. The leads are first wrapped with ruberoid motor cloth, and this is overwound with P. & B. insulating tape. In this manner a very effective equipment and economical insulation is afforded, which appears to be as enduring as it is flexible, and minimizing the number of short circuits which might otherwise arise from defective insulation. A very handsome pocket book, card case and notebook in one, was distributed.

EUGENE MUNSELL & Co. had, in charge of Mr. C. E. Coleman, a very interesting exhibit of their Empire and Micante insulating specialties in their booth on the lawn. Samples of these were made up in handsome little books, so that each visitor could take away pieces of the material with him for investigation and testing. A large quantity of these was handed out during the convention. Mr. Coleman was also very busy discussing with a great many of the street railway managers the qualities of these insulating cloths and papers.

THE STANDARD VITRIFIED CONDUIT COMPANY not only had a very neat exhibit, but, like Rosalind, hung signs on all the trees in the vicinity for the benefit of Orlando, the street railway managers. The exhibit included a great variety of the clay conduit in single and multiple form, and third-rail insulators. Mr. B. S. Barnard, president of the company, was present, and was assisted by his son, Mr. W. H. Barnard, who had charge of the exhibit.

CROCKER-WHEELER COMPANY, of Ampere, N. J., did not make an exhibit but distributed a special bulletin devoted to their generators a growing number of which are being used in street railway service. The company was represented by Messrs. C. W. Startsman, F. B. de Gress, S. Russell, Jr., H. J. Sage and R. N. C. Barnes A souvenir match safe was given away

NOARK FUSES were a constituent part of the H. W. Johns-Manville exhibit as noted in these pages last week, and Mr. Sachs, the inventor, was present. A great hit was made with the pencil got up in the form of a fuse, label and all, and of the exact color, the renewable lead being moved by a turn of the fuse. Everybody in the convention seemed to be carrying one of these.

AMERICAN CIRCULAR LOOM COMPANY was represented by Mr. Otto W. Uthoff, whose firm at St. Louis is agent also for the Banner Electric Company.

GARTON-DANIELS COMPANY, of Chicago, were represented by Secretary J. V. E. Titus.

ROBINS CONVEYING BELT COMPANY had out in a booth on the lawn a working model of their well-known conveyor, operated by electric motor. It was, indeed, one of the features of the exhibit section, and drew a constant and admiring crowd. The concern was represented by C. K. Baldwin, A. B. Proal, John Fuller and M. S. Murray.

E. P. ROBERTS & Co., of Cleveland, were represented by Mr. W. C. Andrews, chief engineer of the New York office.

WESTERN ELECTRIC COMPANY sent to the convention Messrs. R. M. Campbell and R. H. Harper.

BRIDGEPORT BRASS COMPANY, whose "Phono" wire has become widely known among sheet railway men, was represented by Mr. Wylie Brown, of the New York office, who had samples with him.

LE VALLEY-VITAE.—The Le Valley-Vitae Carbon Brush Company made an exhibit of sample boards containing specimens of the brushes it makes, and carbon brushes were distributed at the booth by President J. V. Clarke and Mr. W. H. Bell. They were assisted in their efforts to instruct the street railway men by an "electric advertiser," which did a good share of the talking.

W. R. GARTON COMPANY, of Chicago, was represented by the well-known president, from whom its name is taken. Mr. Garton distributed leather card cases and aluminum letter openers as souvenirs, and was heard to refer accidentally to electrical supplies.

MICHIGAN ELECTRIC COMPANY, of Detroit, was represented by President J. E. Lockwood, who, it is announced, is to take hold of Bullock interests in his territory.

ST. LOUIS EXPOSITION was represented by Prof. W. E. Goldsborough, department of electrical exhibits, and Cloyd Marshall, superintendent of electrical machinery in the department of electricity. Both did loyal service to the cause, viz., a meeting of the Association at St. Louis next year.

E. W. BLISS COMPANY, of Brooklyn, showed in the veranda of the Grand Union Hotel some very fine high carbon steel gears and pinions for all classes of electric railway work, etc. These are called "Projectile Bliss," and illustrate the precision and beautiful accuracy of metal working done by this concern. A working group showed one of the gears meshing into nine pinions, so that their smooth running could be tested.

CONCERNS REPRESENTED.—Among the concerns represented but not exhibiting were the following: S. B. Condit, Jr., of that named company; N. T. Clark, of W. E. Baker Company; A. F. Eslep, of R. D. Nuttall Company; C. E. Speirs, of D. Van Nostrand Company; W. A. Neff, of Forest City Electric Company, Cleveland; John A. Stewart, of that named company; E. F. Kirkpatrick, McRoy Clay Works; G. B. Foster, Wagner Electric Manufacturing Company; J. W. Lyons, Allis-Chalmers Company; W. R. Bonham, Jandus Electric Company and Buckeye Electric Company; E. G. Bernard, of the company of that name; E. Beatty, Electric Motor & Equipment Company; T. J. Creaghead, the Creaghead Engineering Company; F. J. Coakley, Samson Cordage Works; W. C. Egert, Globe Electric Company; W. S. Eckert, National Conduit & Cable Company; E. H. Heilstedt, Chicago Mica Company; H. W. French, Consolidated Engine Stop Company; E. L. Hartpence, Empire Wire Company; H. W. Knott, Elmer P. Morris Company; I. L. Storey, Magneto Electric Company; E. R. Mason, Porter & Berg Company; J. H. Parshall, Ball & Wood Company; Norman McCarty, Diesel Engine Company; H. W. Pope, American Telephone & Telegraph Company; C. E. Meech, Wilmarth & Morgan Company; H. F. Sanville, Waclark Wire Company; W. S. Sisson, D. & W. Fuse Company; G. W. Swan and U. G. Tingley, John A. Roebling's Sons Company; A. P. Eckert, Safety Insulated Wire Company.

AMERICAN ELECTRICAL WORKS, of Providence, R. I., was represented by Messrs. N. J. Watson and Frank B. Baker.

BELL TELEPHONE.—The American Telephone & Telegraph Company extended the courtesy of free long distance telephone service to all active members of the Association, a privilege that was very much appreciated. Messrs. H. W. Pope and Wendell Baker were in attendance.

CHASE-SHAWMUT COMPANY, of Boston, and its specialties, were spoken for by Messrs. H. P. Moore, F. D. Masterson and E. Howe.

NATIONAL LEAD COMPANY, of Chicago, made an exhibit of babbitt metal journal bearings and of Phœnix metal armature bearings, and the display included a journal bearing that had seen continuous service for not less than 13 months under one of the heavy cars operating on the Detroit United Railway, where, it is stated, this metal is now used exclusively on all the cars. It is natural that so important a feature in the work should receive, as it did, considerable attention from the street railway men present. The company was represented by Messrs. J. R. Weithas, of New York; R. D. Pierson, of Detroit, and A. Benzel, of St. Louis.

GOLD CAR HEATING COMPANY had a simple and tasteful exhibit out on the lawn of their well-known electric car heaters. One of the sets was arranged to show the method of regulation. The recent census statistics give a vivid idea of the manner in which electric heating has made its place in the street railway art, and the Gold people are receiving, as they deserve, great credit for their important share in this advance. Among those who represented the company at the convention were Messrs. E. E. Gold, president; J. E. Ward, general manager; W. H. Stocks and Frank Cahill, the chief engineers.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was very dull and entirely professional, there being a holiday feeling and an absence of activity. There was a rather strong undertone of more favorable views about money market conditions, while uncertainty regarding the corn crop and a threatened curtailment of anthracite coal consumption seemingly induced caution. There were few features apart from heaviness in the traction stocks on the unexplained deal in Metropolitan and the reactionary tendency of Amalgamated Copper on an adverse decision. Electrics were weak and listless in sympathy with the general market. Brooklyn Rapid Transit lost ¼ point net on sales of 17,740 shares, the closing quotation being 45½. Metropolitan Street Railway, on total sales of 23,650 shares, declined from 119½, the highest figure, to 111, the lowest, closing at 112¾, this being a net loss of 1¼ points. General Electric fluctuated between 165 and 162, closing at 163—one point lower than last week's closing price. Western Union closed at 83⅛, this being a net loss of ⅝ point. Following are the closing quotations of September 8:

NEW YORK.

	Sept. 1	Sept. 8		Sept. 1	Sept. 8
American Tel. & Cable	70	70	General Electric	163	162
American Tel. & Tel	133	132	Hudson River Tel.	..	..
American Dist. Tel.	23	24	Metropolitan St. Ry.	111¾	112¾
Brooklyn Rapid Transit	45½	43¾	N. E. Elec. Veh. Trns.	..	..
Commercial Cable.	..	..	N. Y. & N. J. Tel.	..	..
Electric Boat	11	13	Marconi Tel.	3	1⅞
Electric Boat pfd.	40	38	Western Union Tel.	83¾	83
Electric Lead Reduction	1¼	1¼	Westinghouse com.	164	165
Electric Vehicle.	6	4⅛	Westinghouse pfd.	170	170
Electric Vehicle pfd.	8	7½			

BOSTON.

	Sept. 1	Sept. 8		Sept. 1	Sept. 8
American Tel. & Tel	133	132½	Western Tel. & Tel. pfd.	82	81¼
Cumberland Telephone	..	..	Mexican Telephone	1¼	1⅜
Edison Elec. Illum.	..	..	New England Telephone	123	124
General Electric	..	..	Mass. Elec. Ry.	21½	21⅜
Western Tel. & Tel	13	13	Mass. Elec Ry. pfd.	80	79½

PHILADELPHIA.

	Sept. 1	Sept. 8		Sept. 1	Sept. 8
American Railways	..	..	Phila. Traction	95⅛	95½
Elec. Storage Battery	56⅜	56⅛	Phila. Electric	8⅜	6¾
Elec. Storage Battery pfd.	56⅜	56⅛	Phila. Rapid Trans.	..	..
Elec. Co. of America.	8¾	8⅝			

CHICAGO.

	Sept. 1	Sept. 8		Sept. 1	Sept. 8
Central Union Tel.	..	..	National Carbon pfd.	88	88
Chicago Edison.	..	..	Metropolitan Elev. com.	..	..
Chicago City Ry.	165	170	Union Traction	4	4½
Chicago Tel. Co.	..	..	Union Traction pfd.	..	..
National Carbon	20	20			

BELL TELEPHONE OF PHILADELPHIA.—President U. N. Bethell, of the Bell Telephone Company, of Philadelphia, has issued, under date September 1, 1903, a circular to stockholders as to the company's issue of $2,000,000 of new stock. The directors have voted to offer to the stockholders 40,000 shares of the new stock of this company for cash at par ($50 per share). Each stockholder will be entitled to subscribe for such new stock in the proportion of one share for every six shares that he then holds; that is, a right will attach to each share of the then outstanding stock to subscribe for one-sixth of a share of new stock, but subscriptions must be for full shares. The right to subscribe will expire at 3 o'clock in the afternoon of Monday, October 12, 1903.

BELL TELEPHONE MERGER.—Articles have been filed with the Secretary of State of New Jersey merging the American Telephone & Telegraph Company of New Jersey, the New York and Philadelphia Telephone & Telegraph Company, and the Midland Telephone & Telegraph Company into the American Telephone & Telegraph Company of New Jersey. The new company has an authorized capital of $130,000, and is a long-distance branch of the Bell Telephone system. The officers are Edward J. Hall, of Morris Township, N. J., president; Edward P. Meaney, of Newark, vice-president; Melville Egleston, of Elizabeth, secretary, and James P. Vail, of New York, treasurer.

DIVIDENDS.—Chicago Telephone directors have declared the regular quarterly dividend of 2½ per cent., payable September 30. The directors of Commercial Cable have declared the regular quarterly dividend of 2 per cent., payable October 1. The Western Union Executive Committee has recommended the declaration of the regular quarterly dividend of 1¼ per cent. The regular quarterly dividend of 1½ per cent. will be paid on Manhattan Railway Company's capital stock October 1 by the Interborough Rapid Transit Company, lessee. The Chicago City Railway Company has declared a quarterly dividend of 2¼ per cent, payable September 30. The directors of the Electric Boat Company have declared a quarterly dividend of 2 per cent on the preferred stock, payable October 1, 1903.

Commercial Intelligence.

THE WEEK IN TRADE.—The tone of reports from business centers shows that there was a spirit of conservatism with a tendency to eliminate anything in the nature of speculation or overextension on general business. Activity continues in manufacturing industries except in some lines of iron and steel. Some improvement is noted in the car situation, and the railroads continue to report larger gross earnings, but increased cost of operations or heavy improvements limit net receipts. Traffic congestion is already noted at several points, despite the fact that crops have only just begun to move, and railway earnings in August show gains of 9.3 per cent. over last year, and 17.4 per cent. over 1901. All jobbing trade reports indicate further improvement. Finished iron and steel are reported in better demand at Pittsburg. The prices of these metals as a whole, however, show little change: the hardware trade is fully up to expectations. Copper ruled quiet but steady throughout the week, a fair volume of business being transacted. Quotations are unchanged at 13¾ to 13⅝c. for Lake; 13¼ to 13½c. for electrolytic; 13 to 13¼c. for cathodes, and 12¾ to 13c. for casting stock. The usual midsummer volume of business failures is noted, although it is pointed out that the August suspensions foot up a larger total of liabilities. The number of failures for the week ending September 3, as reported by *Bradstreet's*, numbered 162 against 142 the previous week, and 133 the corresponding week last year.

KELLOGG TELEPHONE ORDERS.—At the Kellogg Switchboard & Supply Company's factory the following apparatus is in course of construction: A straight multiple exchange equipment is being made for Cleveland, Ohio, with an immediate equipment for 7,680 lines, in 18 sections of three positions each, with an ultimate capacity of 18,000 lines. The new Kellogg four-party selective system is to be installed in connection with this exchange, each cord circuit having a four-button indicating ringing key in addition to the regular cord equipment. This switchboard is to replace the old four-division local battery equipment now in use in Cleveland, which was at the time it was installed nearly four times as large as the largest straight multiple board then made. Common battery exchanges of the latest type are being constructed for the following cities: Pasadena, Cal., 1,500 lines present equipment, mounted in a framework for 7,200 lines ultimate; McKeesport, Pa., 1,000 lines present equipment, mounted in 3,600-line framework; London, England, for Lavender Hill Exchange, National Telephone Company, 800 lines present equipment; Linton, Ind., 800 lines, with 3,000 lines ultimate; St. Louis, Mo., South Office, 2,520 lines, with 7,200 lines ultimate, requiring at present nine sections of three positions each; St. Louis, East Office, 1,080 lines, with 7,200 lines ultimate, requiring five sections for present installation; Taunton, Mass., 300 lines, 800 lines ultimate; also four complete common-battery switchboards of about 400 lines present equipment each, for San Bernardino, Long Beach, Santa Ana and Redlands, Cal. These latter have each an ultimate capacity of 1,200 lines. All the manually-operated switchboard equipment to work in conjunction with the Automatic Exchange at Dayton, Ohio, and Grand Rapids, Mich., is nearly completed at the Kellogg factory. The apparatus for Dayton consists of a multiple toll board of two sections of two positions each, also a wire chief's desk and a combined trouble clerk and information clerk's desk, each of the latter having two positions, both equipped. The Grand Rapids (Mich.) equipment consists of a present equipment of nine two-position sections of multiple tollboard, and one two-position section of rural line board; also a switching section of 12,000 lines equipped for 5,500 lines and a two-position chief operator's desk, a two-position wire chief's desk and two two-position information clerks' desks. The Kellogg Company is also making extensions to the following exchanges: St. Louis, main office, an addition of two incoming trunk sections of four positions each, to work in conjunction with the present four-division main office switchboard. Los Angeles, Cal., is to have a third extension of 1,080 lines, making the total equipment of the exchange 9,120 lines. Vincennes, Ind., is to have a 160 additional equipment, making a total of 800 lines for present operation. St. Charles, Mo., and Belleville, Ill., are to have each an additional section equipment. The greater part of this work is now nearly ready for installation.

WESCO SUPPLY COMPANY.—The following important announcement has been issued by the Western Electrical Supply Company, of St. Louis: "Owing to the constant growth of our business during the past ten years we have found it advisable to increase our cash capital and divide our business into two parts. That portion of our business relating to electrical supplies and its good will and stock of goods, we have sold to the Wesco Supply Company, a new company just organized, with ample capital to continue that business, under the personal management of Mr. R. V. Scudder. The Wesco Supply Company has a large cash capital, and pays us cash for all merchandise and a bonus for good will. The other part of our business, the building of electric light plants and electric railroads, will be retained by ourselves, and we will hereafter restrict ourselves to this branch of our business, and now have on hand contracts calling for orders for nearly a million dollars in this department. All liabilities of the company will be liquidated by ourselves. We expect shortly to increase the capital to $300,000, and will discount all future purchases. The company will continue to be personally managed by Mr. H. K. Gilman, with offices at Chemical Building, St. Louis, Mo. Mr. H. K. Gilman, of the Western Electrical Supply Company, will retain an interest in the Wesco Supply Company and will serve as one of its directors. Both companies will be officered by old employees of the Western Electrical Supply Company, and with ample cash and better facilities than ever before, will undoubtedly continue the record of success made by the old concern."

WASHINGTON WATER POWER.—A dispatch of September 4 from Washington, D. C., says: "The Great Falls power scheme, which the late Benjamin F. Butler set in motion twenty years ago, and which has languished during the interval through financial and administrative difficulties, has been revived, and was to-day given a chance to develop into practical results by the formal approval by the War Department of the plans for the proposed dam. On the endorsement of Gen. Gillespie, Chief of Engineers, the specifications for a dam to be built below the government dam, which fills the reservoirs for the water supply of Washington, are approved, and the work is expected to be begun within a short time. The plans describe a work which will provide electric power for lighting Washington, furnishing motive power for its street railroads and a multitude of other institutions requiring power. The new dam will extend across the Potomac River and join the government dam on the Maryland side. Its construction will make it necessary to raise the government dam two feet. This change in the government property is to be made at the expense of the power company. As the whole work is above the head of navigation, the permission of the government applies only to such questions as are involved in the possible interference with the water supply rights of the government."

45,000 HP of SWISS TURBINES FOR MEXICAN PLANT.—Some important contracts have just been placed for various equipments to be installed in the huge hydraulic plant now under construction at Necaxa, State of Puebla, Mexico, by the Mexican Light & Power Company, Limited, of which concern F. S. Pearson, consulting engineer of the Metropolitan Street Railway, New York, is one of the leading spirits. The initial capacity of the plant which in the first instance is to generate power for transmission to Mexico City, some 90 miles distant, will be 45,000 hp. Ultimately the plant will be capable of generating 80,000 hp. The turbines now ordered will be six in number and of 7,500-hp capacity each. The Swiss engineering firm of Escher, Wyss & Co., of Zurich, secured the contract. Their bid was some $20,000 less than that submitted by American concerns competing. The Riter-Conley Manufacturing Company, of Pittsburg, has been awarded a contract for 1,800 tons of steel pipe varying from 48 in. to 51 in. in diameter. The contract for the generators which will call for six machines of 5,000 kw each, will be let early next month through the New York offices of the company in the Columbia Building, 29 Broadway.

ALLIS ENGINE ORDERS.—The Allis-Chalmers Company, of Chicago, Ill., reports a long list of engine sales for July, including Stilwell-Bierce & Smith-Vaile Co., Dayton, Ohio, one 16-in. x 42-in. girder frame Reynolds Corliss engine. Consumers' Heat & Electric Company, Bloomington, Ill., one 20-in. and 32-in. x 36-in. heavy-duty cross-compound Reynolds Corliss engine. Columbus Buckeye, Lake & Newark Traction Company, Columbus, Ohio, one 34-in. and 68-in. x 46-in. vertical cross-compound condensing heavy-duty Reynolds Corliss engine. Coe Brass Manufacturing Company, Torrington, Conn., one 22 and 44-in. x 42-in. and one 19 and 38-in. x 42-in. combined horizontal and vertical compound Reynolds Corliss engine; two air pumps and two jet condensers. Rock Hill Water, Light & Power Company, Scranton, Pa., one 20-in. x 42-in. girder frame Reynolds Corliss engine. Memphis Consolidated Gas & Electric Company, Memphis, Tenn., one 27 and 72-in. x 48-in. horizontal cross-compound, heavy-duty, direct-coupled Reynolds Corliss engine.

BIG POWER HOUSE.—Work is to be begun forthwith on the power house of the Pennsylvania-Long Island Railroad at Long Island City. All the buildings on the block between Third and Fourth Streets and Front and West Avenue are to be removed at once, and the pile foundations for the power house laid. The power house will be one of the largest in the United States. It will have a frontage of 250 ft. and will cover an area of 125,000 sq. ft. The building will be pushed rapidly to completion so that the trains on the Atlantic Avenue division may be operated by electricity. It is expected that all the foundations will be laid before the cold weather sets in. Sixty-four ducts will be laid for feed wires for the Atlantic Avenue division, between Flatbush Avenue and Jamaica. Westinghouse, Church, Kerr & Co. are the consulting electrical engineers on this plant.

TRUCKS AND MOTORS FOR WELLINGTON, NEW ZEALAND.—The British electrical engineering and contracting firm of Macartney, McElroy & Co., Limited, New York offices Havemeyer Building, has placed contracts through the London offices of the I. G. Brill Company, of Philadelphia, and the General Electric Company for trucks and motor equipments respectively for the Wellington (New Zealand) electric traction system. There will be 27 Brill 21E trucks and eight pairs Brill Eureka maximum traction trucks. The motor equipments will be General Electric, 54 double-type, 500-volt. The car bodies will be built in England, the British Electric Car Company having secured the contract.

BALL ENGINE SALES.—The National Steel Foundry Company, New Haven, Conn., has recently purchased from the Ball Engine Company, Erie, Pa., a 400-hp, tandem-compound engine for direct-connection to a 250-kw generator. Among recent sales made by the Ball company, in Detroit, Mich., are: One 300-hp tandem-compound, direct-connected engine for the Packard Motor Car Company, for the Wills Creek Coal Company; one 300-hp simple engine, direct-connected engines for the Arcade Building; one 300-hp simple engine for the Wills Creek Coal Company; one 300-hp simple engine, direct-connected, for the Detroit Iron & Steel Company.

NEW CHANGEABLE ELECTRIC LETTER SIGNS.—The United Electric Light Company of New Jersey has placed a large contract with the Norden-Bittner Electric Company, New York, for new changeable electric letter signs, which will be used in Newark, Hoboken, Paterson, Camden, Jersey City and Trenton. The Norden-Bittner Electric Company, New York, has purchased the stock and interests of the Knickerbocker Electric Sign & Construction Company, the National Sign Material Company and M. J. Jolly & Co., all manufacturers of electric signs.

NEW ENGINE SHOP.—The S. M. Jones Co., Toledo, Ohio, are building an engine shop 260 x 75 ft., to be equipped to build gas engines of large power. They will also install a foundry plant 100 x 140 ft. They have been manufacturing engines of small size for some years, but the extension is for the purpose of manufacturing multiple cylinder vertical trunk piston engines for electric light service; also horizontal and vertical double-cylinder tandem-compound, double-acting engines for the same class of work, but for larger horse-power; probably nothing below 100 or 150 hp.

EDISON STORAGE BATTERY.—A telegram from Orange, N. J., of September 4 says: "The Pennsylvania Railroad Company is negotiating with the Edison Manufacturing Company with a view of securing a storage battery with which to light its cars. The new iron plate cell which Mr. Edison invented about a year ago probably will be slightly modified to meet the requirements. Though the order has not been actually placed, it is generally believed that it will be for many thousands of the batteries, and that apparatus has been designed which will successfully light trains."

NEW EQUIPMENT FOR CENTRAL BUILDING.—A new electric lighting and power plant is to be installed in the Central Building, 143 Liberty Street, New York. The generators, three of 100-kw capacity each, will be built by the C. & C. Electric Company. The boilers, three units of 150-hp each, will be manufactured by the Babcock & Wilcox Company. Mr. J. P. Hall, of 131 Liberty Street, is letting the contracts.

ELECTRIC CARRIAGE CALL ORDERS.—The Electric Carriage Call Company, New York, has received orders for the carriage calls to be installed in the Hudson Theatre, New York. Six will be put in the Waldorf-Astoria. Through the company's agents in Philadelphia, Kirkpatrick & Binder, orders have been sent for three calls for the Academy of Music and two for the new Bellevue-Stratford Hotel.

ELECTRIC TRACTION FOR MONTEVIDEO.—The city of Montevideo, Uruguay, is to have an up-to-date electric traction system. The horse lines controlled by the London financial house of Baring Brothers, New York connections, Baring, Magoun & Co., will be electrically operated. The lines are known as the Este, Reducto, Pocitos & Bacoe roads. They aggregate about 10 miles in length.

CARS FOR HUDSON RIVER TRACTION COMPANY.—Messrs. Ford, Bacon & Davis, New York, have ordered four cars from the J. G. Brill Company, of Philadelphia, for the Hudson River Traction Company. The motor equipments will be General Electric.

General News.

THE TELEPHONE.

DENVER, COL.—With the completion of a new copper wire circuit between Denver and Cheyenne telephonic communication may be established between Denver and towns as far north as Billings, Montana.

COLUMBUS, GA.—The Adams Telephone system of Stewart County, has been extended to this city.

MACON, GA.—There is some talk of establishing a new telephone system in Macon to oppose the Bell Company. Some years ago another system would have been established had not the Bell Company inaugurated a greatly improved service.

BOISE, IDA.—The Interstate Telephone Company, of Spokane, capitalized at $20,000, has filed articles of incorporation with the secretary of state. The chief place of business of the company will be in Kootenai County.

STERLING, ILL.—E. A. Emmons has organized a telephone company south of this place.

DIXON, ILL.—The officials of the Jo Daviess County Telephone Company have changed the name of their company to Pitcher Telephone Company of Jo Daviess County.

RUSHVILLE, ILL.—The Grange and Illinois Western Telephone Companies have agreed to allow the use of their lines to each others' subscribers. The agreement is for one year.

GREENUP, ILL.—The village board of Mulberry Grove has granted a franchise to E. J. Bancroft, of Greenup, to put in a telephone exchange there. It is the intention of the company to build lines to Woburn, Van Burensburg and Fairview.

EAST ST. LOUIS, ILL.—Preparations are being made by the Kinloch Telephone Company to establish a branch exchange in East St. Louis. It is believed that with a branch exchange much quicker and better service can be given the East St. Louis subscribers on local calls.

JERSEYVILLE, ILL.—The Illinois Telephone Company has withdrawn its petition to the Jerseyville City Council for a franchise to operate its lines within the city limits. Arrangements have been completed with the Jerseyville Telephone Company whereby the toll lines of the former company may be used by the subscribers of the latter.

SHELBYVILLE, ILL.—At a meeting of the stockholders of the recently incorporated Queen City and Shelbyville County Mutual Telephone Company the following named officers were elected: President, T. F. Dove; secretary, W. O. Bennett; treasurer, B. W. Kerr. Directors: Jacob Ulwer, W. O. Bennett, Michael Kessel, E. A. Richardson, W. T. Walker, George Griffith, T. F. Dove.

FORTVILLE, IND.—The Fortville Telephone Company has been incorporated with a capital stock of $10,000.

MOUNT CARMEL, IND.—The Union Telephone Company has been formed, capital $10,000. Directors: J. R. Collins and others.

LAWRENCEBURG, IND.—The People's Telephone Association of Indiana has purchased the line of the Dearborn County Telephone Company.

VAN BUREN, IND.—D. E. M. Beekman and E. O. Woods purchased the Van Buren telephone system of R. W. Lowe. Mr. Beekman sold the plant to Lowe six or seven months ago for $3,000.

ANDERSON, IND.—The strike of the electrical workers' union against the Central Union Telephone Company in this city, Alexandria and Elwood has been declared off and the boycott of the trades councils of the three cities has been lifted. The strike has been on for two months.

WHEATLAND, IND.—The Wheatland Independent Telephone Company has been incorporated by Samuel S. Weaver, John H. Overbay, John S. Nicholson, Charles Nicholson, Andrew E. Nicholson, John H. Niblack and Hamilton Williams, who are also the board of directors for the first year.

INDIANAPOLIS, IND.—The Inter-State Telephone Company, of Wisconsin, has complied with the foreign corporation law by filing a copy of its articles of association with the Secretary of State, showing that $4,000 had been invested in lines constructed in northwestern Indiana.

INDIANAPOLIS, IND.—The Fisher Telephone Company, of Hamilton County, has been incorporated with a capital stock of $5,000. An exchange will be established at Fisher's Station and lines extended throughout the adjoining communities. T. A. Fisher A. F. Beaver, J. A. Noury and A. C. Harrison are directors for the first year.

CARMEL, IND.—The Union Telephone Company has been incorporated with a capital of $10,000. The company will operate throughout the State, but especially in the counties of Hamilton, Boone and Marion. The board of directors includes John R. Collins, William B. Hood, Richard J. Moffit, Albert Kinger and Le Roy J. Pattey.

MARION, IND.—The strike of the electrical workers of the United Telephone Company has been called off, differences settled and the men returned to work. The men have been granted an increase of 25 cents on their daily wages, but the company steadfastly refused to recognize the union in signing an agreement. The strike has been on since August 12. The linemen of the United Telephone Company at Bluffton, Huntington, Ft. Wayne, Gas City and other points have been striking in sympathy with the Marion men.

EVANSVILLE, IND.—A proposition to charge the city $960 a year for new telephones by the Municipal Telephone Company has raised a storm of protestation. The Cumberland Telephone Company is at present furnishing the city telephones free and it is difficult for the citizens to understand why the promoters of the Municipal Telephone Company, who claims to be working so hard "for the interest of the city," want to charge the city $960 for the use of its telephones. The cry is raised that the new telephone company is not going to be municipal.

BLUFFTON, IND.—Twenty-six linemen employed in stringing cables for the United Telephone Company in this vicinity have gone out on a sympathetic strike. They have no grievance, but were ordered out because of a strike at Muncie and Marion by members of the same Electrical Workers' Union with which they are affiliated. The Marion strikers demand an increase from $2.50 to $2.75 a day and a reduction of from 9 to 8 hours. Most of the men are employed by the Butterfield Construction Company, which has the contract for improving the system of the United Company here and in Marion, Hartford City, Montpelier and other points.

DAYTON, IA.—The Farmers' Telephone Company has been voted a local franchise.

HARLAN, IA.—The Harlan & Avoca Telephone Company is extending its service to Tennant.

NEOLA, IA.—The Shelby Telephone Company has finished a line from that city to Neola by way of Persia.

DUBUQUE, IA.—The Iowa Telephone Company will make improvements in its plant at Dubuque and put in conduits.

DES MOINES, IA.—The Shelby Independent Telephone Company has increased its capital stock from $10,000 to $25,000.

CLINTON, IA.—The Clarinda and Shambaugh Mutual Telephone Company has been formed with a capital stock of $2,000. S. R. Turner is president.

DES MOINES, IA.—The Audubon County Farmers' Mutual Telephone Company has been formed; capital $15,000. J. H. Mahony, president, and H. W. Stearns, secretary.

APLINGTON, IA.—The Cedar Valley Telephone Company, with headquarters at Waterloo, put in a local exchange in this little city of about thirty instruments, connected with an automatic switchboard. It will also connect with two farmers' lines recently incorporated by farmers and local business men residing at and near Aplington.

TIPTON, IA.—By an amendment to its articles of incorporation the New Liberty Independent Telephone Company, which is capitalized at $60,000, has changed its name, and headquarters from Scott to Cedar County, by adopting the title of the Tiptor. Independent Telephone Company. The company has a line from Tipton to Davenport connecting with various rural lines along the way.

DES MOINES, IA.—The contract for the erection of the Iowa Telephone Company's building has been let to F. M. Garthwait, of Chicago, for $37,000. The switchboard is now being erected by the Western Electric Company in Chicago. All the down-town wires will be placed in underground conduits and the wires outside of the business district will be on newly erected poles that are now being prepared. The wires will be in cables for the most part. New telephones will be put in over the entire system. The improvements will involve an expenditure of $200,000.

SIOUX CITY, IA.—With the Iowa Telephone Company offering a reduction and large concessions to prevent the granting of a franchise in Sioux City to a rival and the Sioux City Telephone Company, with a freshly signed contract with the independent companies of western Iowa at hand, asking for the right to operate, a telephone war may not be far distant. The Sioux City Telephone Company has practically closed a twenty-year contract for toll connection with the four independent telephone companies which operate about 10,000 telephones within seventy-five miles of Sioux City, provided the Sioux City Company obtains a franchise to operate a telephone system here. By the terms of the contract the independent lines are to construct lines to Sioux City as soon as the Sioux City Telephone Company's lines are laid. The companies included in the contract are the New State Telephone Company, the Cherokee County Telephone Company, the Maple Valley Telephone & Telegraph Company and the New Monona Telephone Company.

COVINGTON, KY.—The council will advertise for proposals for the construction of a telephone, telegraph and messenger system in the city. A franchise was granted a short time ago, but the courts declared it to be illegal.

COVINGTON, KY.—The North Kentucky Telephone & Telegraph Company has applied for a franchise in Covington. The company has recently been organized with $100,000 capital by F. K. Ludlow, M. M. Durrett, S. Kineon and others of Covington.

OWENSBORO, KY.—The Rural Home Telephone Company has filed articles of incorporation. The capital stock is fixed at $25,000. H. K. Cole and J. K. Woodruff, of Owensboro, and F. A. Lundquist, of Chicago, are the incorporators. The company will establish automatic exchanges in small towns in conjunction with the home telephone of this city.

ESQUINAPA, MEX.—A new telephone line has been constructed between this place and La Concepcion.

OCATLAN, MEX.—A telephone system is to be established in this district, embracing Ocatlan and a number of other towns.

MINACA, MEX.—A telephone line is to be built between here and the San Antonio y Anexas hacienda by Baskin & Ten Eyck, of this place.

MACUSPANA, MEX.—A new telephone line has just been constructed between this place and Jalpa and another between Teapa, this state, and the town of Tocotalpa.

GUAYMAS, MEX.—Luis Velasco, who was granted a concession by the government for the establishment of a telephone system here, will soon have the new service ready for operation.

PUEBLA, MEX.—The state legislature has authorized a tax to be levied in the municipality of Porfirio Diaz, the sum thus obtained to be used in constructing a telephone system in that district.

SAN LUIS POTOSI, MEX.—The new telephone line constructed between

this city and the town of Venado has just been opened for business. It was built at the personal expense of Governor Blas Escontria, of this State.

IONA, MICH.—The Palo Telephone Company has been incorporated with a capital stock of $6,000. Directors: F. A. Hargrave and others.

BATTLE CREEK, MICH.—The Jackson & Battle Creek Traction Company now has telephones installed at each switch along the route, so that cars can be dispatched from switches if necessary.

DETROIT, MICH.—The Bell Telephone Company is buying thousands of cedar poles of firms on the Menominee river this year, and it is estimated that it will ship 20,000 poles during the summer months.

HART, MICH.—The Oceana Telephone Company of this city has just installed a 240-capacity generator-call "visual" switchboard in its office in this city. The board is of Stromberg-Carlson make. It has also equipped its Hart, Shelby and Montague offices with Stromberg-Carlson lockout apparatus, and has the same installed on some of its new party lines. So far this summer this company has built 46 miles of new metallic country lines and 10 miles of 10-pin cross arm pole lines. Its new building is now in process of erection.

PARK RAPIDS, MINN.—The Union Telephone Company will build an exchange here.

CYRUS, MINN.—The Stevens County Telephone Company has put in a local exchange at Cyrus.

FOLEY, MINN.—The Maple Leaf Telephone Company has been granted a franchise for a local exchange.

DAYTON, MINN.—The Northwestern Telephone Company will build a line from here to Ithaca and connect with Anoka.

MORGAN, MINN.—The Redwood County Rural Telephone Company will build a line north connecting with the Franklin line.

MINNEAPOLIS, MINN.—The directors of the Tri-State Telephone & Telegraph Company have declared a quarterly dividend.

LEWISTON, MINN.—The Lewiston Telephone Company has been organized at Lewiston and articles of incorporation adopted fixing the capital stock at $10,000. The officers are: President, John Gaffney; vice-president, Henry E. Wirt; secretary, Peter C. Daley; treasurer, B. S. Blanchard.

MINNEAPOLIS, MINN.—The Northwestern Telephone Exchange Company has filed amendments to its articles of incorporation, which will increase the limit of indebtedness from $2,000,000 to $4,000,000. This has been made necessary by the extensions the company has made this season and contemplates making in the near future. Improvements costing $800,000 have been made this year, and extensive alterations of the system are to be completed before the summer is over. The station on the East Side is to be enlarged.

BERTHA, MINN.—The Hewitt-Wrightstown Telephone Company which was organized a year ago, held its first annual meeting at Wrightstown and re-elected the following officers: President, J. E. Stitzel; vice-president, A. A. Burch; secretary, B. Aldrich; treasurer, E. W. Smith. Seven managers were elected, one for each of the seven branches, which center at the head office in Wrightstown. The company's success during the past year has far surpassed the hopes of its supporters. It was organized to erect lines in Otter Tail and Todd counties, but the by-laws were so amended that lines can now be built into all surrounding counties. It was decided to incorporate under the state law.

STURGEON, MO.—The New Century Telephone Company has increased its capital stock from $10,000 to $20,000.

BOONE, MO.—The Centralia Telephone Company has distributed poles preparatory to connecting a line with Tulip.

MADISON, MO.—A mutual telephone project is materializing in this vicinity. Maud, Middle Grove and this place are interested.

RICHLAND, MO.—Mr. E. E. Noe has been granted a 20-year exclusive franchise in this town and will establish a telephone exchange here.

KANSAS CITY, MO.—The Oklahoma & Kansas Telephone Company has purchased the property of the Grant County Rural Telephone Company.

JEFFERSON CITY, MO.—The Harrison County Mutual Telephone Company, of Bethany, has increased its capital stock from $9,000 to $100,000.

CURRANT WINE, MO.—The contracts have been signed for a telephone line from here to Doniphan. T. L. Wright is covering the country with telephone lines.

EXCELSIOR SPRINGS, MO.—The Missouri Valley Telephone Company is extending its line to Excelsior Springs and if the independent line from Kansas City does not meet it there it will be extended into Kansas City.

MOUNTAIN GROVE, MO.—The Mountain Grove Telephone Company, with $10,000 capital, has been organized here. The officers are E. H. Farnsworth, president; Thos. W. Hackworth, secretary, and L. H. Slaughter, treasurer.

BEAVER CROSSING, MO.—At a meeting of the stockholders of the Beaver Crossing Telephone Company held for the purpose of amending the articles of incorporation, the name of the corporation was made the Seward County Telephone Company. The amount of the capital stock of the company is to be $50,000.

DILLER, MO.—The Diller Independent Telephone Company, at its recent annual meeting, declared a dividend, which was paid by the treasurer before the meeting adjourned. The following officers were elected by the board of directors: President, E. S. Loock; vice-president, Thomas Nelson; secretary, A. L. Lintsman; treasurer, J. C. Herwig.

CHILLICOTHE, MO.—The transfer of the Chillicothe telephone system from Leach & McArthur to the Theodore Gary syndicate, which was to have been made August 1, has again been postponed. Funds which were to have been used in making the Chillicothe purchase are understood to have been required at Joplin, where the syndicate also owns the exchange.

ST. LOUIS, MO.—An independent telephone company was organized at a meeting of citizens of St. Louis County, August 28. The meeting was held in a special car, provided by the St. Louis, St. Charles and Western Railroad Company, while making a trip from Wellston to St. Charles and return. Those who signed the articles of agreement were F. A. Heidorn, D. C. Taylor, Ernest Marshall, Fred Essen, Ed Miller, Julius Kessler, Doctor J. D. Pfister, William Wehmeyer, Christ Von Gruben, Alex Kessler, E. Bissell, J. F. Houseman, J. B. C. Lucas, Peter Kerth, Ed Rannells and Henry Weber. Articles of incorporation will be filed as soon as the attorneys for the company can prepare them. The headquarters of the organization will be in Clayton.

BOZEMAN, MONT.—The Yellowstone Park Telephone & Telegraph Company will build a line here from Norris.

BILLINGS, MONT.—D. S. Murray, general superintendent of the Rocky Mountain Bell Telephone, and Hugh Thomas, traffic manager of the company, have just completed a deal for the company's extension.

GREAT FALLS, MONT.—The Rocky Mountain Bell Telephone Company has paid to the treasurer of Cascade County, this State, $1,082 in payment for county licenses on telephone instruments since 1899. The case was contested, and the money paid after a decision by the Supreme Court.

KEARNEY, NEB.—A neat up-to-date directory for the Home Telephone Company has been issued. It contains a complete list of the subscribers in Kearney, numbering about 500, the Platte Valley and other places with several hundred subscribers.

NEWPORT, NEB.—The Newport, Hammond & Southern Telephone Company has been organized with a capital stock of $3,000. The officers are C. M. Thompson, president; L. F. Brown, vice-president; M. E. Smith, treasurer; Robert Good, secretary. The line is already built and doing business from this place to Perch, and Hammond, twenty-five miles south, and branch lines are now being proposed.

MEREDITH, N. H.—The first cable ever laid in the waters of Lake Winnipiscogee has been put down, connecting the New England and Meredith telephone lines together on Bear Island, the second largest island in Lake Winnipiscogee.

JERSEY CITY, N. J.—The Eastern Illinois Independent Telephone Company has been incorporated at Jersey City; capital $500,000. Incorporators: Charles N. King, Le Grand Bouker, W. Monds Greene.

JERSEY CITY, N. J.—The Eastern Illinois Independent Telephone Company has been incorporated at Jersey City; capital, $500,000. Incorporators: Charles N. King, Le Grand Bouker, W. Monds Greene, Jersey City.

ALAMAGORDO, NEW MEX.—The telephone line of the Alamagordo & El Paso Telephone Company between this place and El Paso has been completed.

WESTVILLE, N. Y.—The Westville Telephone Company has been incorporated; capital, $1000. Incorporators: Frank Green, Almarin Baldwin, Thos. Gurney, E. B. Coats, M. A. Stillwell, John M. Cady, K. H. Baldwin, all of Westville, N. Y.

PLATTSBURGH, N. Y.—The Clinton Telephone Company of Plattsburgh has been incorporated to construct lines in Plattsburgh and northern New York. The capital is $50,000 and the directors are John M. Wever, B. S. Ramsey and Isaac Merkel, of Plattsburgh.

JAMESTOWN, N. Y.—A new independent telephone company has been organized in Jamestown, to be known as the Ashville & Panama Telephone Company. The company takes possession of the Appleby telephone lines, which extend through the towns of Busti, Harmony, Chautauqua and Sherman and a portion of Warren County, Pa. The new company elected George W. Appleby, president; Brewer D. Phillips, vice-president, and Alton H. Appleby, secretary and treasurer.

TROY, N. C.—The Troy Telephone & Electric Light Company has been incorporated with an authorized capital of $10,000 and the privilege of increasing to $100,000. The object of the corporation is to operate and maintain telephone and electric lighting systems in the State. O. M. Wade, J. B. Blair and W. A. Cochran are among the incorporators.

ST. MARYS, OHIO.—The St. Marys Telephone Company will install a new automatic switchboard.

DILLONVALE, OHIO.—The Vigilant Telephone Company has been formed with a capital of $3,000.

HAMILTON, OHIO.—The Bell Telephone Company has applied for franchises for a number of extensions to its toll lines in this county.

SEBRING, OHIO.—The Columbiana County Telephone Company has announced an increase in rates. The company claims to be losing money at present rates.

DILLONVALE, OHIO.—The Vigilant Telephone Company, capital $3,000, has been formed by Jacob Barkhurst, Wm. A. Gerke, H. T. Roe, T. O. Guyton and others.

AMSTERDAM, OHIO.—The Kilgore Telephone Company has declared a 35 per cent. dividend on its Harlem-Kilgore line. The wires are now being extended to this place.

VAN WERT, OHIO.—The Central Union Telephone Company has applied for a franchise in Van Wert. The service of the Home Telephone Company has been subjected to considerable criticism of late.

CLEVELAND, OHIO.—The gross earnings of the United States Telephone Company for the first six months of 1903 were $151,726; operating expenses, $89,102; net earnings, $62,604; surplus for stock, $2,883.

CINCINNATI, OHIO.—The managers of the Hamilton Home Telephone Company now have a line into Cincinnati and within the next week or two there will be direct connection between Hamilton and Cincinnati over their lines.

SYCAMORE, OHIO.—The Rural Telephone Company of Sycamore is making great gains in this section and over 50% of the farmers within a radius

of Sycamore are now supplied with the service. New extensions are being planned.

WAPAKONETA, OHIO.—The Buckland Telephone Company has been organized with the following officers: H. D. Bowsher, president; T. B. Bowsher, secretary, and Dr. R. W. Sharp, vice-president and treasurer. The company will build a telephone system in this county.

TOLEDO, OHIO.—The Toledo Home Telephone Company has celebrated the first anniversary of the opening of service in Toledo. The exchange started with 2,500 subscribers and now has 7,300. New cable is to be laid and other improvements will be made at once.

SHARON, OHIO.—W. F. Laubach and H. C. Spicer, receivers for the Sharon & Copley Telephone Company have sold the line to E. A. Hawkins, of Copley, for $800. This line was built eight years ago by W. B. Arnold, and was one of the first to be independently operated in the rural districts.

CLEVELAND, OHIO.—The semi-annual report of the Cuyahoga Telephone Company shows a great improvement in the condition of affairs. Gross earnings for the first six months of the year were $201,565; operating expenses, $104,967; net earnings, $96,598; fixed charges, $58,115; surplus, $38,483.

PORT CLINTON, OHIO.—The new direct line of telephonic connection between Port Clinton and Toledo has been put in operation. The line belongs to the new Ottawa County Telephone Company. There was used in the construction of the new system more than forty miles of copper wire in one continuous stretch.

FREMONT, OHIO.—Stockholders of the Fremont Telephone Company will meet September 8 to vote on a proposition to increase the capital stock from $60,000 to $100,000 for the purpose of installing a new central energy switchboard of the latest pattern. The company is in a very prosperous condition and is earning at the rate of 12% on its common stock.

NEWARK, OHIO.—The directors of the Newark Home Telephone Company have declared a dividend of 1% on common stock. The company has 1,100 telephones in Newark and 750 in the surrounding territory. The Granville exchange will be enlarged and several new farmers' lines will be built. Additional equipment will be purchased for the Newark exchange and the capacity of the toll board will be doubled.

SPRINGFIELD, OHIO.—The work of building the United States Telephone Company's line from the county line to Springfield has been commenced. This city has connection with Dayton over the independent line now, but in order to talk with Dayton it is necessary to connect via Kenton and Columbus, while the new line will do away with this roundabout circuit and give communication with the Gem City direct.

CINCINNATI, OHIO.—The Interstate Telephone Company of Cincinnati has been incorporated with $10,000 capital stock by S. P. Kineon, F. K. Ludlow, Theo Horstman, H. C. Hulbert, Eugene Zimmerman and R. H. Ellison. The company proposes to construct a telephone system between Cincinnati and Dayton and will apply for a franchise in Cincinnati. This will make the third company fighting for a franchise in this city.

CINCINNATI, OHIO.—The Cincinnati Telephone Company has increased its capital stock from $50,000 to $1,000,000. This is the new independent telephone company that proposes to invade the field here. The company has made arrangements to connect with the United States Telephone Company's long distance line. Local capital is largely behind the new company, with some Indiana capital also interested. R. C. McCracken, Jr., is president of the company, and Robt. W. Seebaum is secretary.

SALEM, OHIO.—The city solicitor has been instructed by the council to defend the rights of the people in the matter of the rates fixed in the franchise of the Columbiana County Telephone Company. The company is making an effort to raise rates. The company is controlled by the Federal Telephone Company of Cleveland. It is claimed that the company has invested over $300,000 and that thus far it has operated at a loss of $60,000. The company has 850 business telephones and 1,204 residence telephones in Columbiana County, which is said to be about twice as many as the Bell Company has.

HAMILTON, ONT.—The Bell Telephone Company, under the by-law, is given an exclusive franchise for five years.

INDIANA, PA.—The directors of the Indiana Telephone Company have authorized J. C. Rugh to make improvements on the line in Indiana to the amount of $5,000, changing to the metallic system.

YORK, PA.—The Pennsylvania Telephone Company is making improvements to its lines in this city, which, when completed, will have cost over $15,000 and will then give the people of York as good service as any city in the country.

UNIONTOWN, PA.—The Tri-State Telephone Company has about 500 telephones connected up in Uniontown and about the same number in Connellsville. The remaining 100 in Uniontown are now in working order. The company has decided to build an independent line to secure Pittsburg connections.

CONNELLSVILLE, PA.—C. A. Berg, of the Tri-State Telephone Company, stated that the company has decided to build an independent line from this section to Pittsburg. The company has its line built to Somerset, and is preparing to make connection with the Maryland, West Virginia & Pennsylvania Telephone Company, which will give Fayette County connections with all the towns between here and Cumberland, and beyond that place.

MONTREAL, QUE.—A new telephone system in the city of Montreal and district, is about to be established by the Bell Telephone Company of Canada, at an estimated cost of about $1,000,000. Extensive preparations are being made in the new building, now in course of construction on Hospital Street, to receive the complete new telephone apparatus and equipment. The ultimate capacity of the switchboard will be 9,600 subscribers' lines. In addition to providing for local subscribers, the apparatus will provide a new switchboard for long distance service. In that portion of Montreal, known as the east exchange, telephonically, a new building will be provided. The switchboard in this exchange will also have an ultimate capacity of 9,600 subscribers' lines. There are at present about 14,000 subscribers in Montreal, and provision is being made in the new system for an expansion to 50,000 subscribers. Switchboard provision will be made for 100 long-distance operators; only about 20 operators are now at this special line of work in the city. The growth of the long distance business is exceedingly rapid throughout Ontario and Quebec. Several gangs are now at work in extending lines along the south shore of the St. Lawrence River, connecting many towns and villages that have not, as yet, telephone communication with Montreal. The Bell Telephone Company has also under consideration the improvement of its entire system throughout Canada.

MANNING, S. C.—The Manning Telephone Company has been chartered with a capital of $5,000, by F. C. Thomas, D. M. Bradham and W. E. Jenkins.

JOHNSON CITY, TENN.—The Cumberland Telephone Company is seeking to gain an entrance into this city and has asked the city council for a franchise.

MEMPHIS, TENN.—The Tennessee District Telegraph Company will do business in Memphis. The legislative council, by a vote of 7 to 2, has granted it a twenty-five-year franchise, although it has attached thirteen stringent conditions named by the live-wire committee.

CHATTANOOGA, TENN.—The Hamilton County Telephone & Power Company has been organized. All the stockholders are Chattanoogans and men of wealth. A franchise will be asked for and it will start work on an independent exchange as soon as it is granted.

SONORA, TEX.—A telephone system is being installed here by Rust Bros., of San Angelo, Tex.

SEALY, TEX.—The Southwestern Telegraph & Telephone Company will establish a local exchange here.

LA GRANGE, TEX.—The Commercial Telephone Company is building a new telephone line between this place and Carmine.

PORT ARTHUR, TEX.—It is announced that W. H. Rogers, who is at the head of the Rogers Pipe Line Company, will construct a telegraph and telephone line between this place and Jennings, La.

NAVARRO MILLS, TEX.—The board of county commissioners of this county has granted French & Griffith, of Corsicana, the right-of-way for the construction of a new telephone line to connect this place with the town of Purdon.

SAN ANTONIO, TEX.—It is announced that H. E. Huntington, who recently acquired practically all of the independent long distance telephone lines in Texas, aggregating about 1,000 miles, will immediately expend $400,000 in making extensions of these lines. Frank B. Smith, of San Antonio, who is in charge of the system can give information in regard to the proposed improvements.

AUSTIN, TEX.—It was stated that H. E. Huntington, who recently purchased all of the independent telephone toll lines in Texas, aggregating 1,000 miles, and for which he paid $400,000, has practically closed negotiations for the purchase of the independent telephone exchanges located at Austin, San Antonio, Houston, Corsicana, Waco, Beaumont and nearly a score of other towns in this state, Louisiana and Indian Territory. The amount involved in the purchase of these exchanges exceeds $3,000,000.

SALT LAKE, UTAH.—The Independent Home Telephone Company has announced its intention of beginning the construction of its Ogden building immediately.

SALT LAKE, UTAH.—The Bell Telephone Company, of this city, has absorbed the lines of the Teton Telephone Company by private transfer. The price has not been stated.

SALT LAKE, UTAH.—General Manager Murray, of the Rocky Mountain Bell Telephone Company, has asked the city engineer for a line along which to construct a conduit for the burial of its telephone wires on South Temple Street for a distance of two miles.

LA RUE, W. VA.—The La Rue Telephone Company has been formed; capital $50,000. Charles J. Stehl, La Rue, is agent.

STOREY, WIS.—The Belleville Telephone Company will soon connect lines with the Oregon Company at Story.

MILWAUKEE, WIS.—The Escanaba & Lake Superior Railway has equipped its telegraph lines with composite telephones.

IRON RIVER, WIS.—The Home Telephone Company's exchange at Iron River has been opened, 100 telephones being in use. Direct toll connection has been made with Ashland, and a number of cities down along the line of the Central are placed in telephone communication.

ASHLAND, WIS.—Senator Lamoreux and T. C. Jacks, of the Home Telephone Company, have made arrangements for the building of a toll line to connect Ashland, Washburn and Iron River. Later on the toll line will be extended from Iron River to the head of the lake.

MILWAUKEE, WIS.—The "nickel in the slot" telephone has proven a success, and in the last six months over 1,000 of these instruments have been installed by the Wisconsin Telephone Company, until now about 4,000 are doing a daily business in saloons, drug stores, groceries and residences.

BELOIT, WIS.—The stockholders of the Beloit Telephone Company held their annual meeting recently and elected directors and officers as follows: D. H. Polock, M. J. Ward, C. A. Gault, Chas. Franz and W. H. Grinnell. President, Chas. Gault; vice-president, M. J. Ward; secretary and treasurer, D. H. Polock.

LAKE NEBAGAMON, WIS.—A new telephone company has been recently organized at Lake Nebagamon, a small town. Forty telephones have been installed and it is thought that very soon the number will have grown to sixty. The company expects a large patronage from the farmers. The officers are W. S. Carr, president; B. F. Jare, secretary, and M. Hendrickson, treasurer. All are business men of Superior.

ELECTRIC LIGHT AND POWER.

LANETT, ALA.—It is stated that the establishing of an electric light plant is being considered.

DADEVILLE, ALA.—Bids will be received Sept. 22 for constructing an electric light plant in this city at a cost of between $7,500 and $10,000. J. H. Lovelace is clerk. Press reports state that the City Council has ordered an election to be held Sept. 21 to vote on the question of issuing $10,000 bonds to install electric lights. It is stated that a dam will be built at Black's Shoals, about two miles from Dadeville, and power transmitted from there.

LITTLE ROCK, ARK.—The College Hill Light & Traction Company has been chartered. The capital stock is $195,000, all subscribed. E. K. Smith is president; J. D. Sanderson, vice-president; E. J. Spencer, secretary; J. L. Chatfield, treasurer.

REDLANDS, CAL.—The Holton Power Company intends to develop the power of East Side canal at a cost of about $75,000. The time for receiving bids has not yet been decided upon. W. F. Hoet is president.

LEWES, DEL.—Bonds to the amount of $10,000 are reported sold for the purpose of extending the electric light plant and sewerage system.

TAYLORVILLE, ILL.—Wm. J. Mower has petitioned for a franchise for an electric light plant.

FRANKLIN, KY.—The Franklin Electric Company will increase the capacity of its lighting plant by the addition of a 30-kw alternator, exciter and switchboard, and also one 50-hp automatic engine. The machinery has been purchased and will be installed by Mr. W. H. Isbell. It will also probably add a number of new alternating street lights and extend its lines in the near future.

TEHUACAN, MEX.—Ramon de la Fuente has let the contract for the installation of the new electric light plant here.

CHILPANCINGO, MEX.—A new electric light and power plant is to be installed here. It will supply the city with 50 arc and 200 incandescent lights.

ACAPULCO, MEX.—Thomas Levison, an American claiming to represent a Pittsburg, Pa., syndicate, has been investigating the situation here with the view of establishing an electric light and power plant.

TAMPICO, MEX.—At a meeting of the Tampico Electric Light & Power Company the stockholders authorized the capital stock to be increased from $150,000 to $225,000. The company let the contract for installing its electric light and power plant to a Germany company. In addition to supplying the city with lights, the company will also furnish power for industrial concerns of the city.

BOYNE CITY, MICH.—The Council has granted an electric light franchise to Ernest A. Stowe and C. C. Follmer, of Grand Rapids.

LANSING, MICH.—The Alpena Heat, Light & Power Company, of Alpena, $500,000 capital, has filed articles of incorporation. The company was incorporated under the laws of Maine although it seems to be strictly a Michigan company.

LYONS, MICH.—The Ionia Electric Company has completed its concrete dam in Grand River. The water is carried through a stone flume to the power-house, in which are two Leffel water wheels, and the power is carried to Ionia, seven miles distant, at 2,500 volts.

HALLOCK, MINN.—J. S. Leary is reported interested in the construction of an electric light plant.

BAGLEY, MINN.—M. J. Kolb and John Bohmer have secured a franchise for an electric light plant.

FAIRMONT, MINN.—An ordinance is before the Council to provide for the issue of $16,000 electric light bonds.

ST. CHARLES, MINN.—The St. Charles Electric Light Company has been incorporated, with a capital of $10,000, for the purpose of installing and operating an electric light plant in this city, until such time as the city is able to purchase same. N. Kiefer is reported interested.

ST. LOUIS, MO.—The Suburban Electric Light & Power Company has increased its capital stock from $10,000 to $100,000, all the increase being paid.

WASHINGTON, MO.—A. A. Tibbe has sold the electric light plant and the telephone system to Henry Hibbler and John Earnst. The new firm took charge of the business the same day. Mr. Hibbler is assistant cashier of the bank of Washington and Mr. Earnst is the proprietor of a greenhouse at the same place.

FARMER, N. Y.—It is reported that the Ovid Electric Light Company, of Ovid, will extend its lighting system to Farmer.

ROCKWOOD, PA.—The contract for the town lighting plant has been awarded to the Iron City Engineering Company, Pittsburg, Pa.

PORTAGE, PA.—The Portage Light, Heat & Power Company has been incorporated here. Incorporators: H. A. Tompkins, J. J. McDonnell and others. It is stated that the purpose of the company is to supply current to Portage and neighboring communities, including Wilmore, Puritan, Cassandra and Jamestown.

LOYSBURG, PA.—Bedford Electric Light, Heat & Power Company is reported to have been organized with $250,000 capital to harness the stream below Loysburg. The water will be carried two miles by a conduit about 6 feet in diameter. A power house will be erected and a large main wire will be placed along the line connecting Loysburg, Waterside, Woodbury, Martinsburg, Rolling Springs, Hollidaysburg and Altoona on the north and Bedford County towns on the south. Harvey Linton, of Altoona, is the engineer. An electric road is also being considered.

HOUSTON, TEX.—The new power house which the Houston Electric Company to be erected here will cost about $11,000.

SAN MARCOS, TEX.—The San Marcos Electric Light & Power Company is enlarging and otherwise improving its plant at this place. William Greene is president of the company.

AUSTIN, TEX.—It is proposed to establish an electric light and water works plant at Austin for supplying lights and water for the several state institutions situated here. The legislature at its last session appropriated $155,000 for this purpose. Dr. B. M. Worsham, superintendent of the State Insane Asylum, can give information.

AUSTIN, TEX.—The Austin Electric Light & Power Company has entirely rebuilt its system and enlarged its power plant. This was rendered necessary in consequence of the break in the big dam at this point in April, 1900. The company now has a very complete steam plant on its property, which gives much better satisfaction than did the old water power.

BURLINGTON, VT.—According to the preliminary estimates submitted to the Board of Aldermen by Prof. Freedman, the cost of constructing a municipal electric light plant of 250-kw will be about $56,390, and $20,000 per year for operation.

MENOMONIE, WIS.—An important water power development is being planned at this point. It is intended to utilize the entire power of the Red Cedar River, including the powers at this point and at Rice Lake, a distance along the river of nearly 70 miles. It is calculated that there will be a minimum of 10,000 horse power available. The Wisconsin Power Company is developing the enterprise and Mr. J. H. Colter, of Chicago, is the principal promoter of the new company.

CAMBRIA, WIS.—The village will vote on the establishing of a lighting plant.

NEW LONDON, WIS.—Reports state that the proposition to issue electric light plant bonds carried.

STEVENS POINT, WIS.—The Stevens Point Lighting Company is stated to have purchased the water power at Jordan on Plover River, and will transmit electrical power to this city.

THE ELECTRIC RAILWAY.

PUEBLO, COL.—The surveying corps of the Rapid Transit Company in charge of R. L. Kelly, has about completed preliminary surveys for the electric railway projected to connect Pueblo with the Beulah Valley, 30 miles southwest. The railway expects to do a large freight business, and already has assurances of a business of 1,000 tons a day. The road will start at the post office in Pueblo. It is possible that a plant will be located at the coal mines in the vicinity of Florence and high-tension power lines built to substations on the road. The following are officers: George Peck, of Cincinnati, Ohio, president; John J. Burns, of Pueblo, vice-president and secretary; James N. Carlisle, of Pueblo, treasurer. The constructing company is known as the Pueblo & Beulah Realty & Construction Company, and W. A. Beatty, room 17, Opera House Block, Pueblo, is the president and general manager.

SPRINGFIELD, ILL.—The Decatur, Tuscola & Champaign Railroad Company has been incorporated. The capital is $5,000. The incorporators are J. H. Culver, Charles S. Hankins, William H. Black, J. M. Clokey, D. L. Campbell, J. L. Ray, Ashton Campbell, Charles Eckhart and A. W. Wallace.

INDIANAPOLIS, IND.—The directors of the Indianapolis & Shelbyville Traction Company are receiving bids for the construction of 28 miles of road between Shelbyville and Greensburg. Robert C. Light is president of the company.

INDIANAPOLIS, IND.—Charles F. Smith, general manager of the Indianapolis & Martinsville Rapid Transit Company, is advertising for bids to construct 24 miles of road between Martinsville and Bloomington. There will be about a quarter of a mile of tunneling.

LAKE CHARLES, LA.—An interurban electric railway is to be constructed between this place and Grand Lake, a distance of eighteen miles. City Engineer C. M. Boren, of this place, can give information.

NEW IBERIA, LA.—The New Iberia Railway Company has been organized here for the purpose of constructing and operating an interurban electric line between this place and Morgan City. The contract for the construction of the road will soon be let.

WORCESTER, MASS.—According to a statement made by President Ned C. Hinds, of the Hartford & Worcester Street Railway, work on the construction of this line will soon be begun on locations granted in Massachusetts. James F. Shaw & Company, of Boston, are to build the line.

BOSTON, MASS.—The Boston & Northern Street Railway Company is purchasing land along Highland Avenue, Salem, for a new electric line which will connect Town House Square, Salem, and the Scollay Square, Boston, by an almost direct route, enabling cars to make the distance in an hour's run.

MARLBORO, MASS.—Extensive improvements are planned for the Marlboro Street Railway, which has recently passed into the hands of James F. Shaw, of the Boston & Worcester Street Railway Company. The Boston & Worcester system of safety appliances, by the use of telephones, flags, lights and torpedoes, is to be adopted. The line runs from Marlboro Junction to Hudson, and through cars are operated between Hudson and South Framingham over the Framingham, Southboro & Marlboro Street Railway.

VERA CRUZ, MEX.—The street railway line which is owned and operated by the Cementerio Particular Veracruzano, S. A., is to be extended from its present terminus to the Alameda. Additional equipment will also be purchased.

PUEBLA, MEX.—A committee of the city council has been appointed to arrange for the extension of the street railway system here from the Paseo de Bravo to the Cerro de San Juan. The company will purchase a considerable amount of building material and additional rolling stock. Dr. Miguel A. Salas, of this city, can give information.

FRONTERA, MEX.—It is stated that the Orizaba Rubber Plantation Company, of Chicago, Ill., which owns an extensive plantation situated near here, will soon commence the construction of an extensive electric railway system which will be used principally to transport freight. It is proposed to utilize the falls of the Tulija River for the purpose of obtaining power for operating the system. Colonel J. B. Sanborn is president of the company.

SAUK RAPIDS, MINN.—The Watab Dam Improvement Company has under advisement the project of establishing an electric railway from here to Watab, a distance of three miles, and also a line to the granite quarries, two miles north of town. The plans are being prepared by engineers of the company, and a report will be ready in a few weeks.

ST. LOUIS, MO.—The St. Louis & Olivet Railway Company has been incorporated, with a capital stock of $100,000. The incorporators are W. Carl Feld, S. S. Senne, E. H. Daves, A. W. Werremeyer and W. E. Heapes.

ALBUQUERQUE, NEW MEX.—The Albuquerque Traction Company has been organized here with a capital stock of $250,000.

NEWARK, N. J.—The eleven officials and directors of the North Jersey Street Railway Company indicted for manslaughter in connection with the Clifton Avenue grade crossing accident of Feb. 19 last, in which nine pupils of the Newark City High School were killed, were placed on trial before Chief Justice William S. Gummere in the Circuit Court here Aug. 31. They were acquitted, the jury rendering a verdict of "not guilty."

TRENTON, N. J.—After a delay of nearly three months the Delaware Valley Traction Company has obtained a franchise in Ewing Township. The ordinance empowers the company to construct a road, beginning at the city line, near the State Hospital, and proceeding out the Birmingham road through Trenton Junction to Birmingham. This franchise, together with the Hopewell franchise gives the company a continuous line through Mercer to the Hunterdon County line. The company already has a franchise in Lambertville, and the only break in the route is about a mile and a quarter in West Amwell Township, in Hunterdon County. It is probable that a petition will soon be sent to Common Council for permission to extend the road into the city from the State Hospital to the entrance of Cadwalader Park. As soon as all the franchises are obtained, work of construction will be begun.

BROOKLYN, N. Y.—It is said that the Brooklyn Rapid Transit Company proposes to prosecute every conductor who may be caught acting dishonestly, instead of simply discharging each man and putting him on its blacklist, as has been the policy heretofore.

ROCHESTER, N. Y.—The Rochester & Easton Railway, which is being built between Rochester, Canandaigua and Geneva, N. Y., is expected to be completed and ready for operation about Sept. 15. Forty-one miles of track have been laid, the poles and brackets have been placed, and the remainder of the work is confined to stringing wires. There are two power houses, one at Canandaigua and the other at Geneva. A large car house has also been built at Canandaigua, where the offices of the company will be located.

CINCINNATI, OHIO.—A deal is now pending between the officers of the Cincinnati, Lawrenceburg & Aurora Traction Company, the Cincinnati Interterminal Company and the Indianapolis & Shelbyville Southeastern Traction Company, which, if completed, will link Cincinnati and Indianapolis with a direct line.

YOUNGSTOWN, OHIO.—The Youngstown & Southern Electric Railway Company, which is building a line from this city to East Liverpool, is in negotiation with builders for three electric engines of the largest type, each to haul 20 cars of 50 tons capacity. The company will open up the coal fields between here and East Liverpool that never before have been tapped.

NEWARK, OHIO.—The Newark, Martinsburg & Mt. Vernon Traction Company has just been organized with the election of the following officers: Edward H. Everett, president; Dr. J. W. Shromtz, vice-president; John A. Chilcote, treasurer; F. E. Elliott, secretary; Edward Kibler, counsel. The company has secured practically the whole right of way from Newark to Martinsburg and from Gambier to Mt. Vernon by private plan.

OTTAWA, ONT.—Mr. Roland L. Porthiem, of Edinburgh, Scot., and several other English capitalists, are promoting the project of running an electric railway in the province of Ontario, from Port Stanley to Hamilton through Woodstock, St. Thomas, London and Brantford.

PETERBOROUGH, ONT.—At the meeting of the City Council, the franchise to the Peterborough & Ashburnham Radical Electric Railway Company, which is practically the American Cereal Company, was agreed upon. The principal clauses of the franchise provide that 5 miles of railway within the town are to be equipped and in operation not later than July 1, 1904. The plans of the company include extensions to Dabburnham, Lakefield, Young's Point and Chemong.

ALLENTOWN, PA.—The Blue Ridge Traction Company has filed thirteen extensions at the Recorder's office, in Allentown, showing proposed lines aggregating 48.7 miles.

DOYLESTOWN, PA.—It is the intention of the New Jersey & Pennsylvania Traction Company to extend its line from Newtown to Willow Grove and make a connection with the lines of the Union Traction Company, of Philadelphia, within a year. The line is to be built via Richboro, Southampton, Davisville and Hatboro.

HARRISBURG, PA.—The directors of the Harrisburg & Lewisberry Street Railway Company have decided to extend the line from Lewisberry to Bowmansville by way of Lisburn. The final merger of the Harrisburg & Lewisberry Street Railway Company and the Star Street Railway Company is expected in a few weeks.

PITTSBURG, PA.—E. H. Converse & Company, Pittsburg, have secured the contract for preparing plans and specifications for the Paulsboro Traction Company, whose proposed line is to extend from Woodbury to Paulsboro and Billingsport, and thence to Swedesboro, via Clarksboro, in New Jersey. Surveys will be commenced at once. Messrs. Converse & Company will be pleased to hear from parties interested.

WILKESBARRE, PA.—Counsel for the Lehigh Valley Railroad has petitioned the Court to restrain the city of Wilkesbarre from interfering with or preventing the construction of the railway tracks on the old canal bed of the new electric line, which seeks to enter the city over that route. The city has policemen stationed at all crossings, and refuses to allow the employees of the company to proceed with the laying of the tracks under the threat of arrest.

BERWICK, PA.—The Berwick & West Nanticoke Electric Railway Company has purchased the old Pennsylvania Canal Company's dam at Nanticoke, where it will build a power plant for the purpose of operating not only its own cars, but those of the Columbia & Montour Traction Company. The company has also acquired the right to use such sections of the old towpath as may be available in getting its tracks from Berwick to West Nanticoke. Negotiations are also pending for an extension to Plymouth, where connections would be made with the Wilkesbarre & Wyoming Valley Traction system.

MONTREAL, QUE.—The directors of the Montreal Street Railway have decided to ask the shareholders of the company for power to make an issue of $1,000,000 stock additional. A special meeting of the shareholders will be held on September 10, and if the issue is agreed upon, it will be offered to the shareholders at par. The object of the directors in asking for new capital, is to improve the road bed and construct new lines and cars. With the new stock issue, the company will have a capital of $7,000,000 in stock.

PROVIDENCE, R. I.—The Providence & Taunton Street Railway Company it is said is considering the extension of its tracks to Hunt's Mills.

WOONSOCKET, R. I.—A second survey is being made by the Providence & Burrilville Street Railway Company of the route of its proposed line between Woonsocket and Providence. The route is through North Smithfield, Lincoln and Smithfield to Centerdale, and will be several miles shorter than the present railway route. President Ray, of the Woonsocket Street Railway Company, is interested in the project.

CLARKSVILLE, TENN.—The local street railway company of Clarksville has in view several possible extensions.

MEMPHIS, TENN.—The City Railway Company has applied for a charter at Memphis. It is proposed to have a capital of $50,000. The incorporators are St. Louis capitalists, and are: F. R. Harns, R. P. Cary, W. A. Buckner, T. T. East and M. M. Bosworth.

CORPUS CHRISTI, TEX.—The city council has granted Moling Bros., a franchise for an electric street railway and an electric light and power plant.

CLARKSVILLE, TEX.—A movement has been started looking to the construction of an interurban electric railway between this place and Paris, Texas, by way of Mt. Pleasant and Bogata.

BEAUMONT, TEX.—It is announced that the Beaumont, Sour Lake & Port Arthur Traction Company's line which is now being constructed to Sour Lake will be continued from that place to Saratoga, a distance of about ten miles.

SALT LAKE CITY, UTAH.—United States Senator Reed Smoot and Hon. E. C. Loose, Provo capitalists, have under contemplation the construction of an electric railway from Provo to Brigham City, covering the portion of the state where the business traffic is greatest.

BEAUMONT, TEX.—It is stated that the Beaumont, Port Arthur & Port Neches Electric Company will build a power house. The machinery will be placed to furnish power for operating more than 200 miles of electric road doing freight and passenger business and to furnish power for the oil fields at Beaumont, Sour Lake and Saratoga. Designs for the system are now being drawn, and, according to reports, the order for the machinery will be placed shortly.

NEWPORT NEWS, VA.—The Hampton Roads Railway & Electric Company has filed a mortgage on its plant for $300,000, to cover a bond issue for that amount. The bonds are issued for the purpose of making extensive improvements.

NORTON, VA.—The Wise Coal Company is said to be interested in a scheme to build an electric railway system to the coal fields of Southwest Virginia, connecting Norton, Big Stone Gap, Tom's Creek, Appalachia and a half-dozen other mining towns.

SPOKANE, WASH.—The Chelan Railway & Navigation Company, with a capital stock of $350,000, has decided to construct an electric railway system, which will connect Chelan with Chelan Falls and Chelan Lake with Columbia River.

EAU CLAIRE, WIS.—The Chippewa Valley Electric Railroad Company has filed an amendment increasing its capital stock from $200,000 to $400,000, and enlarging the scope of its business so as to enable it to furnish electric power for manufacturing and commercial purposes.

THE AUTOMOBILE.

AUTOMOBILE BEER DELIVERY.—The Anheuser-Busch Brewing Association will inaugurate an automobile service for the delivery of its beer. Two machines, said to be the largest of their kind in the world, were received by the firm August 18. The practicability of the vehicles will be thoroughly tested and if the service meets expectations, 176 more of the same kind will be ordered. The automobiles are 24 feet long 10½ wide and the wheels have tires three inches in width. They have a carrying capacity of 30,000 lbs. The vehicles will be operated by electricity and geared to a speed of 20 miles an hour. In business and congested thoroughfares, however, this rate will be materially reduced. It is thought that the entire service will be operative by the first of November. The installation of this service by the company means a displacement of 216 wagons and 432 horses. Each automobile will cost $2,700.

NEW INDUSTRIAL COMPANIES.

THE SNELL ELECTRIC SIGN COMPANY is to establish a plant at Toledo, Ohio. The company will manufacture an automatic electric Block signal intended for use on electric railway.

THE RUTLEDGE MANUFACTURING COMPANY, of Brooklyn, N. Y., has been incorporated to manufacture dynamos; capital, $5,000. Directors: Lincoln G. Gochen and John S. Ross, of Brooklyn, and Frank Kling, of Manhattan.

THE CLIMAX ELECTRICAL SUPPLY & CONSTRUCTION COMPANY, of Bluefield, W. Va., has been incorporated to deal in all kinds of electrical supplies. Capital $10,000. Incorporators: W. P. Hawley, P. M. Walizer, R. S. Jones, T. A. Martin, W. A. Pankey, of Bluefield, W. Va.

PERSONAL.

PROF. F. A. C. PERRINE, president of the Stanley Electric Manufacturing Company, is visiting San Francisco.

PROF. WILHELM OSTWALD sailed for Europe Sept. 8, his engagements there rendering his present visit to this country very brief. Prof. Ostwald hopes soon, however, to make another and more extended visit.

GEN. IRVING HALE, of Denver, the well-known representative there of the General Electric Company and recently president of the Denver Charter Convention, has been in poor health since his Philippines campaign and has now been ordered East for a long rest and vacation.

MR. B. OVERLY has been appointed general manager of the United States Telephone Company at Cleveland, Ohio, to succeed Mr. H. H. Robinson, who resigned on September 1 to accept the General Managership of the Illinois Telephone & Telegraph Company, of Chicago, as noted last week.

MAJOR G. O. SQUIER, Signal Corps, U. S. A., is now in San Francisco, having completed his tour of foreign service, and is now stationed as chief signal officer of the military department which includes California, Nevada and the Hawaiian Islands. His experience in cable laying in the Philippines has been quite unique.

MR. J. F. MACARTNEY, of the British electrical engineering and contracting firm of Macartney, McElroy & Co., Limited, is now in the States en route for New Zealand, where he will go in connection with the construction of the Wellington electric traction system. His firm has the contract valued at about $650,000 for the construction of the permanent way, the overhead equipment and the rolling stock.

PROF. W. E. AYRTON will sail Oct. 3 for the United States as a member of a British Commission to study American educational methods. President Butler, of Columbia, has drawn up for the Commission an elaborate itinerary of visits. The Commission is being sent by Mr. Alfred Mosely, who some time ago sent to this country a delegation of representatives of British trade unions to report on American industrial methods.

MR. J. R. LOVEJOY, manager of the Railway Department of the General Electric Co., was presented on Thursday, September 3, with a handsome silver punch bowl and ladle, by some forty representatives of the railway department. The street railway convention at Saratoga brought many of these together and thus enabled them to participate personally in the presentation. It is needless to say that Mr. Lovejoy was utterly surprised and not less appreciative of this mark of esteem and friendship on the part of his staff. In fact he confessed during the day that the episode had rather unnerved him for the duty of presiding at the luncheon given at the works to the convention.

MR. C. N. DUFFY, the well-known secretary and auditor of the Chicago City Railway Company, has resigned from that position to become comptroller of the Interurban Street Railway Company and the allied Metropolitan properties, and has assumed his new duties. Mr. Duffy was formerly secretary and treasurer of the St. Louis Union system. He was one of the organizers of the Street Railway Accountants' Association and president of that body in 1900. He is a man of great force of character and of most amiable disposition, but a rigid disciplinarian in all matters of finance. He is a powerful accession to the Metropolitan staff and a decided acquisition for financial and electrical circles in New York City.

Trade Notes.

STONE & WEBSTER announce the removal of their offices in Boston to the new India Building, State Street corner of Merchants' Row, dating from September 1.

PORCELAIN SOCKETS.—The latest publication of Pass & Seymour, Solvay, N. Y., is a pamphlet descriptive of their line of porcelain sockets, which includes types for all classes of electrical work.

HOBART GAS ENGINE DYNAMO.—By a printer's error, the address of the manufacturers of the gas engine type dynamo described in these columns last week was given as Troy, N. Y., instead of Troy, Ohio.

THE F. BISSELL COMPANY, Toledo, Ohio, gives in a recent folder an illustrated list of their specialties, including an automatic portable hand lamp, pole platforms and seats, cable cars, trolley and line fittings.

THE WACO ELECTRICAL SUPPLY COMPANY, Houston, Tex., of which Charles A. Hobson is general manager, will erect a large building in which it will establish a branch electrical supply house.

CATALOGUES WANTED.—The Electro-Dynamic Company, 212 Ionic St., Philadelphia, asks us to say that it will be pleased to have manufacturers of machinery send copies of their latest catalogues to it, addressed to T. D. Brown, Pur. Agt.

THE VOUGHT-BERGER COMPANY, La Crosse, Wis., has issued a neat folder descriptive of a new telephone—No. 45—which it is placing on the market. A number of improvements have been introduced in this type, which is so constructed that it can readily be changed from series-magneto to bridging and vice versa, and for use on common-battery circuits.

THE THOS. E. CLARK WIRELESS TELEGRAPH-TELEPHONE CO., Detroit, Mich., announces that it is erecting stations at Pontiac, Mich., on the State Fair Grounds, for the purpose of carrying on commercial telegraphing. The company has just issued another bulletin with a full description of its instruments, and information on "Space Telegraphing," by Thos. E. Clark.

INDUSTRIAL ELECTRICITY.—With this title Sargent, Conant & Co. have issued a well-written pamphlet outlining their method of doing business, which is that of contracting engineers. Given the results wished to be accomplished, and the conditions under which these results are to be obtained, an estimate is given of the cost at which the necessary plant will be furnished installed and ready for action.

DUNCAN WATT-METERS.—The Duncan Electric Mfg. Company, Lafayette, Ind., in its bulletin No. 1 of 28 pages, gives an excellent technical description of the Duncan type of integrating watt-meter for direct current lighting and power service. All the details of the meter are illustrated and described at length. The final pages of the book contain instructions for cleaning meters in service; testing and installing meters, and instruction for reading dials.

C. & C. MOTORS.—Bulletin No. 145 of the C. & C. Electric Company is confined to a partial list of the users of C. & C. motors taking service from the mains of the New York Edison Company. No less than 30 large sized pages are necessary to contain this list. The extent to which this type of motor is used in New York City is well illustrated by the fact that the list of churches in that city in which it has been installed contains more than three score names.

MONTHLY CALENDARS.—The practice of sending out monthly calendars appears to be increasing. The remarkably handsome biographical calendar cards of the Bullock Electric Company are well known, and we have recently received calendar cards from the Pittsburgh Transformer Company and the Lumen Bearing Company, of Buffalo, N. Y. The former owes its very artistic appearance to a well-disposed oval portrait of a handsome maiden, and the latter to a picture in colors of a vessel at sea.

THE COAL HANDLING MACHINERY installed by the C. W. Hunt Company, of West New Brighton, N. Y., at the Lincoln Wharf power station of the Boston Elevated Railroad Company has recently lowered the world's record for rapid unloading. The coal was raised 90 feet above tide water and delivered to the storage pockets at the rate of 320 tons per hour. The installation follows in general design the standard Hunt steeple tower rig, the moving gear and coal cracker being electrically driven and the hoisting engine direct connected. The overhand of the folding boom is 40 feet, and the capacity of shovel 2 tons.

EUREKA TELEPHONE.—One of the handsomest telephone catalogues that we have thus far seen is that recently issued by the Eureka Electric Company (No. 23). The 70 pages are printed on half-tone paper of the finest quality and the illustrations are excellent examples of the best grade of high-tone work. The stamped cover indicates how an excellent effect may be produced with the absence of any color. The catalogue contains little short of 100 excellent illustrations showing the long line of telephonic apparatus manufactured by this company, which includes everything in telephonic installations from the smallest detail up to exchange switchboards.

"NEW AMERICAN" TURBINES.—A pamphlet that will be much appreciated by the hydraulic engineer and others interested in water-power development has just been issued by the Dayton (O.) Globe Iron Works Company. The 98 pages, which are printed on excellent paper, include finely executed half-tone engravings of numerous hydraulic installations employing the "New American" turbine, as well as detail illustration of all types of this turbine. The final pages contain sections giving technical information on the measurement of water powers, construction of wheel pits and head and tail races, directions for setting wheels, and also several useful tables.

WESTINGHOUSE CIRCULARS.—Three recent trade publications of the Westinghouse Electric & Mfg. Company have for their respective subjects "Direct-Connected Railway Generators," "Westinghouse 68 and 68C Railway Motors," and "Type S Motor." The first mentioned illustrates and describes in detail a class of railway generators ranging in power from 100 to 2,700-kw and in speed from 300 to 75 r.p.m. Among the illustrations of the circular on railway motors are two sets of curves setting forth all the important data of operation. The Type S motor is illustrated in open, semi-enclosed and enclosed form, and tables give the speed and weight of sizes from 1½ to 20-hp.

THE SANGAMO ELECTRIC COMPANY and its hustling agents, the Electric Appliance Company, announces the placing upon the market of the Gutmann duplex watt-meter for alternating current. The Gutmann watt-meter is well known and its high qualities are accepted as facts, but the new duplex meter is a boon to the 50 volt plants which in the course of time are likely to change to 100 volts. This meter can be used with equally accurate results on 50 volts and 100 volts without any change whatever in the mechanism of the motor, and without calibration. The only modification that is necessary when a plant which has the duplex motor installed, changes its lighting circuit from 50 to 100, is to send its meter man from house to house changing the shunt wire connection from the binding post marked 50 volts to the binding post marked 100 volts. The Gutmann duplex watt-meter is identically the same in appearance as the standard 100 volt meter and is of the same weight and dimensions. Instead of having a single shunt wire connection in the connecting box underneath the meter proper it has two shunt connections, one marked 50 volts, the other 100 volts.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPTEMBER 1, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

736,489. TELEPHONE APPARATUS; Charles G. Burke, Brooklyn, N. Y. App. filed Feb. 14, 1901. (See page 442.)

736,548. ELECTRIC SYSTEM OF TRANSMISSION; Robert A. Ripley, Stamford, Conn. App. filed June 13, 1902. (See page 442.)

736,556. PAPER-HOLDING DEVICE FOR TELEPHONES; William Hale Sherman, Newport, R. I. App. filed May 8, 1902.

736,616. INDICATOR ATTACHMENT FOR BELLS; Charles E. Munroe, New York, N. Y. App. filed Jan. 5, 1903.

737,566. ELECTROLYTIC APPARATUS; George Bell and George William Bell, Liverpool, England. App. filed June 18, 1901. (See page 441.)

737,575. ELECTRIC INCANDESCENT LAMP; Walter B. Burrow, Norfolk, Va. App. filed July 2, 1902. Carbon plugs holding the ends of the filament are set into a two-part stopper occupying the neck of the lamp.

737,576. MAGNET CORE FOR DYNAMO ELECTRIC MACHINES; Walter B. Burrow, Norfolk, Va. App. filed Aug. 14, 1902. A triangular passage is formed through the core for the insertion of a piece of metal on one side or the other of the passage to determine the direction of the magnetic flux through the core.

737,582. RESILIENT MULTIPLE CONTACT TROLLEY; Edward S. Cobb, Los Angeles, Cal. App. filed April 14, 1903. The flange and tread of the wheel are made up of a series of spring plates against which the wire bears.

737,589. ELECTROMAGNET; William M. Davis, Chicago, Ill. App. filed April 26, 1901.

737,590. TELEPHONE EXCHANGE SYSTEM; William M. Davis, Chicago, Ill. App. filed Dec. 2, 1901.

737,608. THRESHOLD ILLUMINATING DEVICE; George Hail, Providence, R. I. App. filed March 11, 1903. An incandescent lamp is arranged at elevator landings to throw its rays across the threshold whenever the elevator door is opened, so that passengers may clearly see the relative position of the landing and the floor of the car.

737,613. ELECTRIC BATTERY; Henry Halsey, New York. App. filed Dec. 6, 1902. To decrease in a battery the polarization due to gases, he exhausts the gases by means of a pump.

737,614. ELECTRIC BATTERY; Henry Halsey, New York. App. filed Dec. 6, 1902. The electrodes are in form of cylinders which are so mounted as to be revolved in opposite directions in order to stir the electrolyte thoroughly.

737,635. ELECTRIC ALARM FOR ELEVATORS; Fred O. Kinnecom, Providence, R. I. App. filed Feb. 24, 1903. A magneto generator supplies current while the car is in motion to operate alarm bells at the various landings before the car reaches them.

737,659. SUSPENDING DEVICE; Conrad M. Pitel, Meriden, Conn. App. filed March 6, 1903. A spring drum arrangement for the flexible suspending cord of an incandescent lamp.

737,661. JUNCTION BOX, CONDUIT AND ELECTRIC WIRING MECHANISM; Frederick J. Ravlin, Chicago, Ill. App. filed April 7, 1903. A junction box to be applied to a roof in a water tight manner, and having internal passages through which branch wires can be led from the box into the building, all parts being well insulated and weather-proof.

737,668. ELECTRIC ARC LAMP; Albert Schweitzer, Pittsburg, Pa. App. filed Sept. 18, 1899. Details.

737,689. ELECTRIC HEATER OR RHEOSTAT; Charles Wirt, Philadelphia, Pa. App. filed Dec. 5, 1902. Two-part clamps for the ends of the resistance units are arranged in a series and held together by a single clamping rod.

737,703. SELF-INDUCTION COIL; George A. Campbell, Newton, Mass. App. filed Feb. 8, 1902.

737,704. SELF-INDUCTION COIL; George A. Campbell, Newton, and Wilton L. Richards, Malden, Mass. App. filed Feb. 8, 1902.

737,710. ANTI-INDUCTION METHOD FOR TELEPHONE SYSTEMS; William Condon and Albert Barrett, Kansas City, Mo. App. filed March 24, 1902.

737,711. ANTI-INDUCTION TELEPHONE SYSTEM; William Condon and Albert Barrett, Kansas City, Mo. App. filed March 24, 1902.

737,715. TELEPHONE-EXCHANGE SYSTEM; William M. Davis, Chicago, Ill. App. filed Dec. 2, 1901.

737,720. ELECTROMAGNET; James Duncan, Boston, Mass. App. filed June 1, 1903. (See page 442.)

737,764. MODE OF AND APPARATUS FOR REGULATING THE CHARGE AND DISCHARGE OF STORAGE BATTERIES USED IN CONJUNCTION WITH DYNAMO ELECTRIC MACHINERY, ETC; Robert S. McLeod, Manchester, Eng. App. filed Jan. 19, 1903. The regulation is accomplished by providing a booster having several field coils so connected to the various circuits to be regulated that the voltage of the booster changes in magnitude and sign so as to insure a comparatively uniform output of the generating plant notwithstanding fluctuations in the load.

737,781. SELF-WINDING ELECTRIC CLOCK; Emil Schultz, Potsdam, Germany. App. filed July 2, 1901. Details.

737,823. ELECTRIC ARC LAMP; Tito L. Carbone, Grunewald, Berlin, Germany. App. filed Dec. 30, 1902. General improvements in a lamp in which the electrodes are inclined to each other at an acute angle, each electrode consisting of two carbon rods, also inclined to each other at an acute angle.

737,824. ELECTRIC ARC LAMP; Tito L. Carbone, Grunewald, Berlin, Germany. App. filed Jan. 6, 1903. Further improvements in a lamp similar to the preceding.

737,825. ELECTRIC ARC LAMP; Tito L. Carbone, Grunewald, Berlin, Germany. App. filed March 25, 1903. In a lamp of the character above described, the arc is held steady by a magnetic ring surrounding it, said ring being connected with the core of a coil by a number of rods and the coil being adjustable in position along the core to shift the influence of the magnetic lines upon the arc.

737,840. ELECTRIC LOCK; William H. Hollar, Philadelphia, Pa. App. filed March 10, 1902. The operating devices for the bolt work which ordinarily consist of springs having to be compressed by the operator each time the door is locked, are, in this case, operated by an electric motor.

737,866. INDICATOR FOR LOCATING SUNKEN METALS; Charles F. Pike, Philadelphia, Pa. App. filed Aug. 22, 1902. A bell containing a pivoted arm is let down into the water and the arm allowed to drag upon the bottom; when it strikes a magnetic object, its angular position which is indicated by suitable mechanism on the deck of the vessel, determines the location of the object.

737,869. SELECTIVE SYSTEM; Sylvanus Albert Reed, New York, N. Y. App. filed Aug. 1, 1901. (See page 442.)

737,870. SELECTIVE SYSTEM; Sylvanus Albert Reed, New York, N. Y. App. filed Dec. 31, 1902. (See page 442.)

737,882. PROCESS OF ELECTROLYTICALLY PREPARING LITHOGRAPHIC PLATES; Otto Carl Strecker, Darmstadt, Germany. App. filed April 19, 1900. (See page 441.)

737,890. INCANDESCENT LAMP SOCKET; Joseph L. Yost and Owen E. Kenney, Toledo, Ohio. App. filed June 12, 1903. Details.

737,894. SUPPORT FOR TELEPHONE-RECEIVERS; Ephraim Bass, New York, N. Y. App. filed Nov. 22, 1902. (See page 442.)

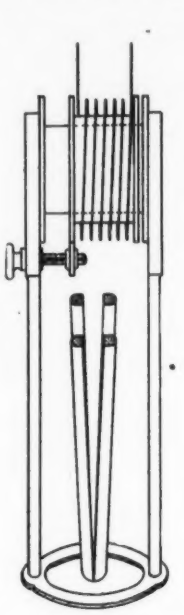
737,896. RAILROAD BOND; Horace M. Bellows, Huntingdon Valley, Pa. App. filed May 18, 1903. The opposed ends of the rails have aligned recesses in which there is a coiled spring forming the bond.

737,900. ALARM ATTACHMENT FOR ELECTRIC BELLS; Henry Blakeney and A. Riley Baker, Dallas, Tex. App. filed June 30, 1902. By turning a lever a vibrating bell can be changed into a tap bell.

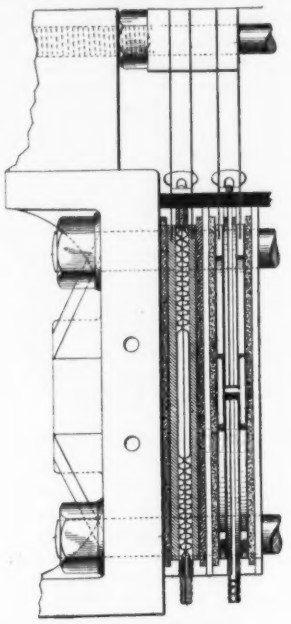
737,922. DROP-SWITCH FOR TELEPHONES; George L. Gulliford, Bloomington, Ill. App. filed Dec. 2, 1902.

737,935. THIRD RAIL FOR ELECTRIC RAILWAYS; Lloyd G. Johnstone, New York, N. Y. App. filed June 9, 1903. An electric heater is applied to a third rail for the purpose of melting ice that may form thereon.

737,936. CONTACT DEVICE FOR ELECTRIC RAILWAYS; Henry F. Kellogg, Wellesley, Mass. App. filed Oct. 15, 1902. Instead of a trolley wheel, a number of independently movable blocks are bunched together and formed with a groove along which the wire runs.



737,825.—Electric Arc Lamp.



737,982.—Rheostat.

737,946. SUPPLEMENTAL BASE FOR OUTLET BOXES; George L. Martin, New York, N. Y. App. filed March 4, 1903. A supplemental base of special construction that can be applied to boxes of different sizes and shapes.

737,949. CIRCUIT CONTROLLER; Edwin J. McAllister, Newark, N. J. App. filed July 29, 1902. An apparatus for controlling the various circuits of an electric sign.

737,982. RHEOSTAT; Edward Weston, Newark, N. J. App. filed July 9, 1902. A rheostat composed of a series of electrodes in combination with a fluid medium under pressure for regulating the contact between the electrodes to vary the current flow therethrough.

738,025. DRY CELL BATTERY; Edwin R. Gill, New York, N. Y. App. filed Dec. 20, 1901. The carbon electrode is in the form of a conical screw which is driven into the powdered material of the battery and thereby compresses a thin layer of such material adjacent to the electrode to furnish good contact between the two elements.

738,056. TROLLEY; Moses Nicholls and Clark J. Smith, Ottumwa, Iowa. App. filed Dec. 15, 1902. Details.

738,059. SCREW ATTACHING MEANS FOR ELECTRICAL DEVICES; Henry T. Paiste, Philadelphia, Pa. App. filed July 20, 1901. To prevent a screw from working loose, it is given a prismatic head and countersunk in a cavity which permits the head to turn therein when it is set in place, but which is filled with a compound to act as a lock for the screw.

738,078. ELECTRIC BELT FOR MEDICAL PURPOSES; Ebenezer Smellie, Glasgow, Scotland. App. filed April 3, 1903. Details.

738,094. ELECTROLYTIC PROCESS; Arthur Brichaux, Brussels, Belgium. App. filed Oct. 4, 1898. (See page 441.)

738,099. INCANDESCENT LAMP SOCKET; Walter A. Church, Binghamton, N. Y. App. filed June 20, 1902. Two half sections of insulating material are screwed together to form a block and provided with internal chambers for the reception of the various metallic and movable parts of the socket.

738,110. REVERSIBLE GALVANIC BATTERY; Ernst Waldemar Jungner, Norköping, Sweden. App. filed April 17, 1899. (See page 441.)

738,113. SYSTEM OF ELECTRIC LIGHTING; Henry Leitner, Woking, and Richard N. Lucas, Byfleet, England. App. filed Dec. 22, 1902. A system of train lighting in which two dynamos are used in a manner to neutralize the effect of changes in the speed to maintain a constant voltage. The invention resides particularly in inserting resistances in the various circuits, some of which are of a nature to increase their conductivity when heated, while others are of the opposite nature.